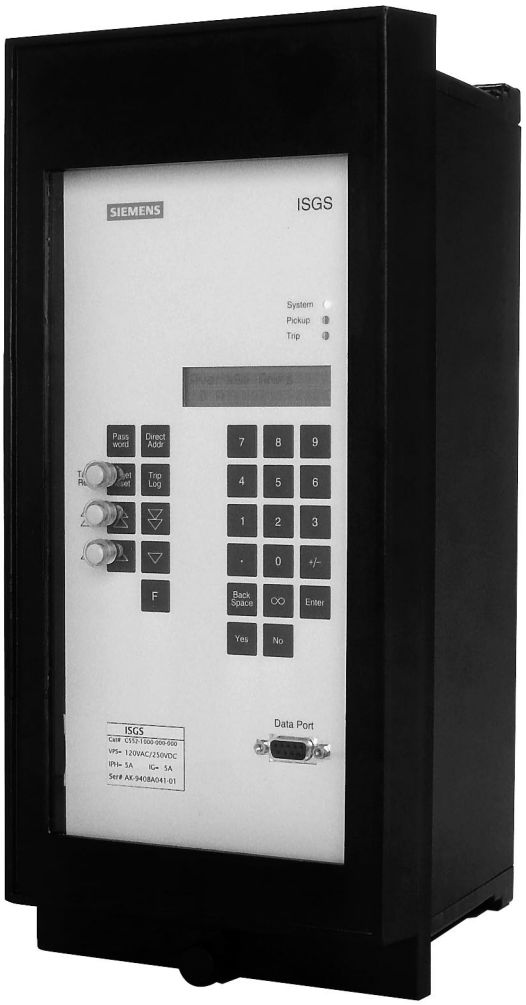
SIEMENS

ISGS™

Intelligent SwitchGear System
Operator's Manual–firmware version V3



Manual No. SG8158-00

⚠ DANGER

Hazardous voltages and high-speed moving parts.

Will cause death, serious personal injury, or equipment damage.

Always de-energize and ground equipment before maintenance. Read and understand this instruction manual before using equipment. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions that will cause severe personal injury or equipment damage. Follow all safety instructions contained herein.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

QUALIFIED PERSON

For the purposes of this manual, a qualified person is one who is familiar with the installation, construction, or operation of the equipment and the hazards involved. In addition, this person has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety procedures.

(c) **is trained** in rendering first aid.

NOTE

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office.

The contents of the instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Energy & Automation, Inc. The warranty contained in the contract between parties is the sole warranty of Siemens Energy & Automation, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

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1 Introduction

The Intelligent SwitchGear System (ISGS™) from Siemens is a high-speed, numerical, microprocessor-based protective relay designed to be easily incorporated into a computer-monitored medium voltage power system. The relay is designed and manufactured in accordance with the latest provisions of the applicable IEEE, ANSI, and NEMA standards. You must thoroughly read and understand this operator's manual before you begin any work with the ISGS relay. Successful application and operation of this equipment depends as much upon proper installation and maintenance by the user as it does upon the careful design and fabrication by Siemens.

1.1 About this Manual

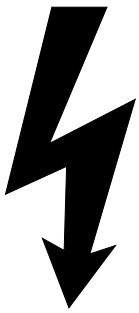
The purpose of this manual is to assist the operator in developing safe and efficient procedures for the installation, maintenance, and use of the equipment.

This manual provides the necessary information to safely install, operate, configure, maintain, and troubleshoot the ISGS relay. In addition, the manual offers worksheets for parameter settings, acceptance test procedures, and troubleshooting. For quick reference, a complete menu structure, metering accuracies, trip curves, equations, and schematics are included in the appendix.

Contact the nearest Siemens representative if any additional information is desired.

1.2 Safety

⚠ WARNING



Electrical equipment operates at high voltages.

When operated inproperly, this equipment can cause death, serious personal injury, and property damage.

To avoid electrical shock, burns, and entanglement in moving parts, this equipment must be installed, operated, and maintained only by qualified person thoroughly familiar with the equipment, instruction manuals, and drawings. Read and understand this manual before using the equipment.

Qualified Person

For the purpose of this manual and product labels, a **Qualified Person** is one who is familiar with the installation, construction, and operation of this equipment, and the hazards involved. In addition, this person has the following qualifications.

- Training and authorization to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices
- Training in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety procedures
- Training in rendering first aid

Signal Words
The signal words **Danger**, **Warning**, and **Caution** used in this manual indicate the degree of hazard that the user or operator can encounter. These words are defined as follows:

- **Danger** - indicates an imminently hazardous situation which, if not avoided, *will* result in death or serious injury
- **Warning** - indicates a potentially hazardous situation which, if not avoided, *could* result in death or serious injury
- **Caution** - indicates a potentially hazardous situation which, if not avoided, *could* result in moderate or minor injury

Required Procedures
In addition to normal safety practices, user personnel must adhere to the following procedures:

1. Always work on de-energized equipment. Always de-energize a breaker or contactor, and remove it from the equipment before performing any tests, maintenance, or repair.
2. Always perform maintenance on equipment employing springs after the spring-charged mechanisms are discharged.
3. Always let an interlock device or safety mechanism perform its function without forcing or defeating the device.

Field Service Operation
Siemens can provide competent, well-trained Field Service Representatives to provide technical guidance and advisory assistance for the installation, overhaul, repair, and maintenance of Siemens equipment, processes, and systems. Contact regional service centers, sales offices, or the factory for details.

1.3 Product Description

The ISGS relay is a general purpose, multifunction, microprocessor-based protective relay. It performs protection, metering, and monitoring for three phase current transformer (CT) inputs and one ground CT input.

The ISGS relay provides two breaker tripping contacts and one relay disabled (alarm) contact. The relay disabled contact is a normally closed contact which opens when the relay is functioning properly.

1.3.1 Standard Configuration

The ISGS relay base unit includes the following standard protection, metering, and monitoring features:

- Instantaneous Phase Overcurrent (50) protection
- Instantaneous Neutral or Ground Overcurrent (50N) protection
- Phase Time Overcurrent (51) protection
- Neutral or Ground Time Overcurrent (51N) protection

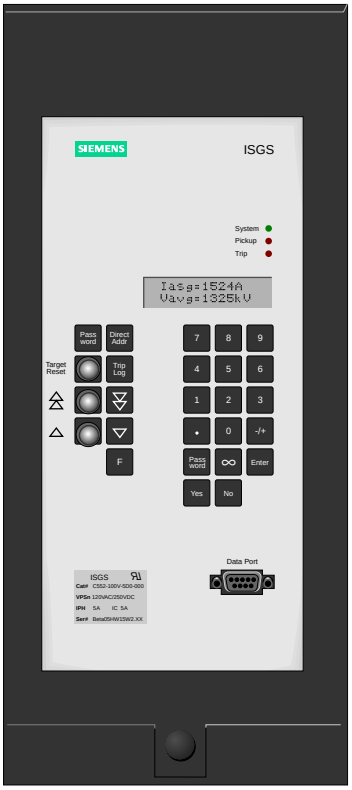


Figure 1.1 Intelligent SwitchGear System (ISGS) Relay

- Nine selectable time overcurrent curves and one custom curve
- Breaker Failure (50BF) protection
- Phase and neutral current as well as average current metering
- Minimum/maximum logs for storing metering data
- Waveform capture
- Trip log for recording information on last eight trip events
- Event log for monitoring and recording relay functions for status changes
- 2-line by 16-character liquid crystal display (LCD) for viewing measured data
- 26-key membrane keypad for local access and selected manual data entry.
- LED indicators for general relay status information
- Standard RS-232 communications port for local access to all parameter settings using a personal computer (PC) and Wisdom™ software
- Password security

The ISGS relay is supplied in an M1-size drawout case with dust tight front cover. The case is compatible with XLA connecting plugs that are commonly used to test relays.

1.3.2 Optional Configurations

The ISGS relay is a dynamic, feature-rich device that can be used in numerous industrial and utility applications. It allows the addition of options or configuration changes at any time without discarding the basic hardware.

There are four optional configurations that can be added to the ISGS relay base unit.

Metering
Adding metering to the ISGS relay provides the relay with three inputs for the connection of VTs. Each input can be set from 100 V to 120 V. These inputs extend metering capabilities as follows:

- Rms and average rms voltages
- Active and apparent power
- Kilowatt demand and kilowatt demand hours
- Power factor
- Frequency

The installation of the voltage input card now also allows the setting of these protective functions:

- High-Set Instantaneous Phase Overcurrent (50HS)
- High-Set Instantaneous Neutral or Ground Overcurrent (50HSN)

The metering option is also a prerequisite for the next two options: additional protective functions and remote communications.

Additional Protective Functions
For an ISGS relay with the metering option installed, the following additional protective functions offer a powerful extension of its protection capabilities:

- Under/Overvoltage (27/59)
- Phase Sequence Voltage (47)
- Negative Sequence Voltage (47N)
- Directional Time Overcurrent (67/67N)
- Over/Underfrequency (81U/O)

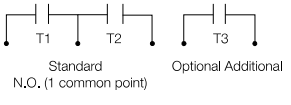
Communications
Adding communications to the ISGS relay provides the relay with an RS-485 port. Using the SEAbus™ communications protocol, this port allows remote communications and control via the ACCESS™ electrical distribution and communication system (ACCESS system).

Communications allows configuration, measurement, and protection functions to be performed or reviewed easily from a remote location using Wisdom software.

1.4 Wisdom Software

While it is possible to completely set up and configure the ISGS relay using the front panel keyboard and display, the free Wisdom software package provided with the relay reduces the complexity of configuring the relay, reading metered values, and retrieving stored data. For more information on Wisdom software, refer to **Chapter 8**.

1.5 Technical Specifications

Applicable Standards	
ANSI / IEEE C37.90-1989	IEEE Standard Relays and Relay Systems Associated With Electric Power Apparatus
IEC 255-4	Single Input Energizing Quantity Measuring Relays With Dependent or Independent Time
General Technical Data	
Operating ambient temperature	-20°C to +55°C (-4°F to +131°F)
Storage temperature	-40°C to +75°C (-40°F to +167°F)
Relative humidity	The average relative humidity may be up to 55% outside of enclosure for temperatures up to 40°C, with excursions up to 95% for a maximum of 96 hours, without condensation.
Altitude	< 1500 meters
Frequency	50 Hz or 60 Hz, software selectable
Power Supply AC/DC	
DC Rated voltages	48 V (19-56 V), 125 V (46-144 V), 250 V (92-288 V)
Permissible ripple	<10%
AC Rated voltage	120 V rms (102-132 V, 50-60 Hz)
Power consumption	<15W
Input Circuit Ratings	
Rated current (I_n)	1 or 5 A, independently for phase and ground inputs
Maximum input current	4 x I_n continuous
	10 x I_n for 10 s
	100 x I_n for 1 s
CT burden	<0.1 VA for 1A CT
	<0.5 VA for 5A CT
Rated voltage (V_n)	115 or 120 volts
Maximum input voltage	for measurement: 1.25 x V_n MOV protected at: 2.5 x V_n
VT burden	150kΩ
Trip Circuit	
Tripping relays	2 or 3
Contact configuration (Trip 1, Trip 2, Trip 3)	
Contact rating	IEEE/ANSI C37.90-1989, Section 6.7 (Make and carry 30 A for at least 2000 duty cycles, resistive load, interrupted by independent means. Duty cycle: 200 ms on, 15 s off, 250 V)

Trip Circuit (continued)	
Binary output contacts (BO1 and BO2)	2 x N.O. (independent, not rated for tripping)
Maximum switching voltage	300 VDC, 250 VAC
Maximum switching current	8 A
Maximum switching capacity (for currents not interrupted by independent means)	DC: voltage dependent; 50 W at V ≥70 VDC 100 W at 48 VDC 270 W at 35 VDC AC: 2000 VA
Trip source monitor	215 mA for 48 VDC supply 63 mA for 125 VDC supply 36 mA for 250 VDC supply Source quality checked approximately every 4 minutes
Isolation	
Applicable standards	ANSI/IEEE C37.90-1989, IEC 255-4, IEC 255-5
Between all circuits (except communications interfaces, analog inputs and outputs) and ground, and between these circuits.	2 kV rms, 50/60 Hz, 1 minute
Between communications interfaces, analog inputs and outputs and ground, and between these circuits	500 VDC, 1 minute
Across open contacts rated for tripping	1500 V rms, 50/60 Hz, 1 minute
Across open contacts not rated for tripping	1000 V rms, 50/60 Hz, 1 minute
Impulse	
Applicable standards	IEC 255-4, IEC 255-5
For all circuits (except communications interfaces, analog inputs and outputs), transverse and common mode	class 3, 5 kV, 1.2/50 µs, 0.5 J
RS-485 and local communications interfaces, analog I/Os	class 1, 0 kV
Electrostatic Discharge	
Applicable standards	IEC 801-2 (test without cover)
Contact discharge	class 3, 6 kV
Air discharge	class 3, 8 kV
Surge Withstand Capability	
Applicable standards	ANSI/IEEE C37.90-1989, IEC 255-4, IEC 255-22-1, IEC 41B (CO) 53
For all circuits except communications interfaces, analog inputs and outputs	ANSI: Oscillatory and Fast Transient, transverse and common mode IEC: Class 3, 2.5 kV
For RS-485 interface, analog inputs and outputs	IEC: Class 1, 0.5 kV
Electromagnetic Field	
Applicable standards	ANSI/IEEE C37.90.2
All six faces	10 V/m (+100%, -0%), 2-1000 MHz

2 Installation

This chapter explains the installation of the ISGS relay and includes procedures for unpacking, storing, mounting, and wiring the relay. Prior to installation, ensure that the system power is off and that you have all required tools and test equipment available.

2.1 Unpacking

Upon receipt of the relay, inspect the carton for signs of damage. If the carton has been opened or damaged, carefully inspect and verify the contents against the packing list. If pieces are missing or damaged, contact the shipping agent or your Siemens representative. Refer to **Figure 2.1** to identify the different parts of the relay.

Note: To avoid damage to the relay, transport or store the relay in the original packing material. Always transport the cradle assembly inside the case.

Figure 2.1 Case, Cradle, Paddles, and Cover of ISGS Relay

2.2 Storing

Extended storage of the relay should adhere to the following guidelines:

- Store the relay in a clean, dry location in the original packing material
- Storage temperature range is -40°F to +167°F (-40°C to +75°C)

Note: This device contains electrolytic capacitors, which can degrade over time when stored at temperatures over 86°F (30°C). Take care not to store the relay at high temperatures for extended periods.

After extended storage, connect the relay to its auxiliary voltage source for one or two days prior to taking it into actual service. This serves to regenerate the electrolytic capacitors of the auxiliary supply.

2.3 Mounting

The ISGS relay is typically installed in a switchgear unit or relay panel. The required panel opening and a side view of the relay are shown in **Figure 2.2**.

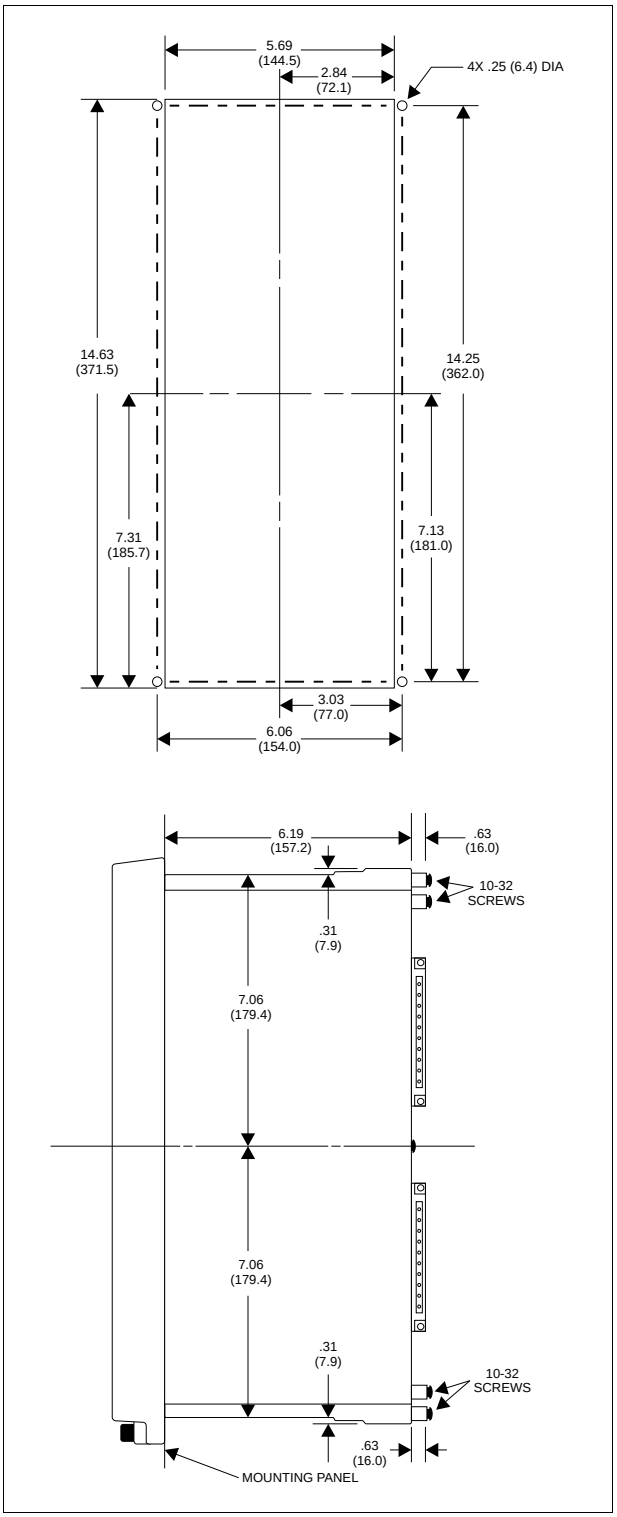


Figure 2.2 Mounting Dimensions

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Mount the relay using the following steps.

1. Install the relay M1-type case in the panel opening on the switchgear equipment.
2. Connect the case ground to the terminal lug on the back of the M1-type case as shown in **Figure 2.3**.
3. Wire as described in **Section 2.4**.

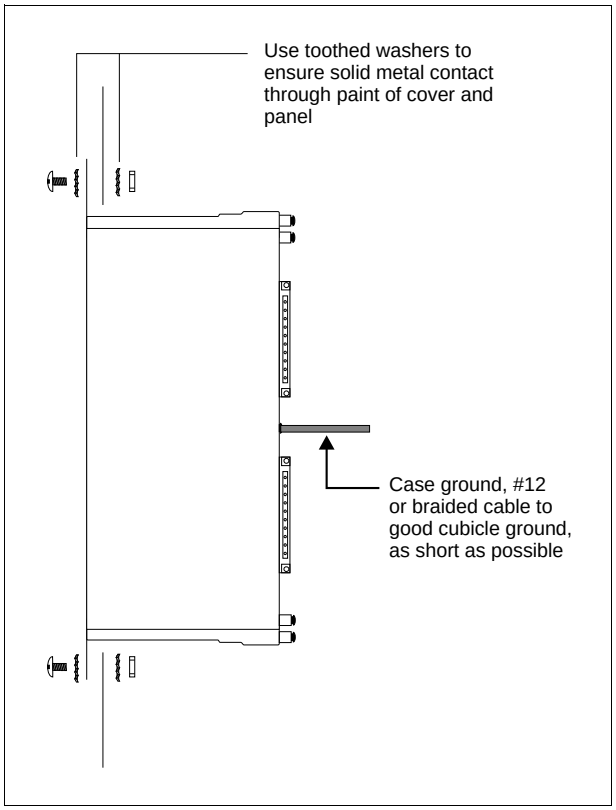


Figure 2.3 Case Grounding

2.4 Wiring

Wire the ISGS relay after the case is installed. Connect the wiring to the applicable terminals to support the desired features. Refer to **Figure 2.4** for terminal locations. **Figure 2.5** shows the internal connections of the ISGS relay. To avoid injury to personnel or the equipment, perform power connections after all other wiring has been completed.

Assure that all power is off before performing any wiring. Terminals 1 through 20 accept ring-tongue or forked spade terminals and are suitable for 14 AWG to 10 AWG wire. Terminals 21 through 60 are for directly inserting the appropriate wire and are suitable for 22 AWG to 14 AWG wire.

Communications connections made to terminals 48 to 50 require shielded twisted pair wire.

CT connections should be made with the polarity end of the CT connected to current terminal marked with an asterisk (*).

IMPORTANT:
Any unused terminals must remain disconnected. They are for factory use only.

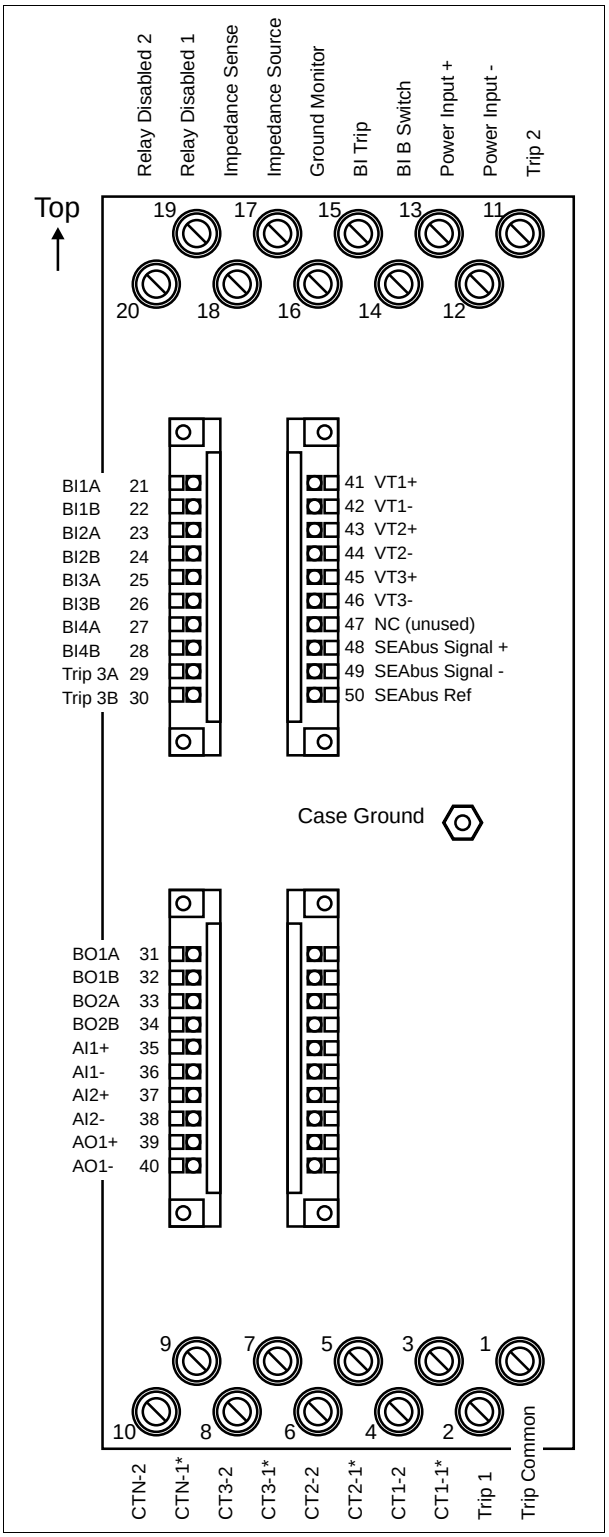


Figure 2.4 Terminal Locations

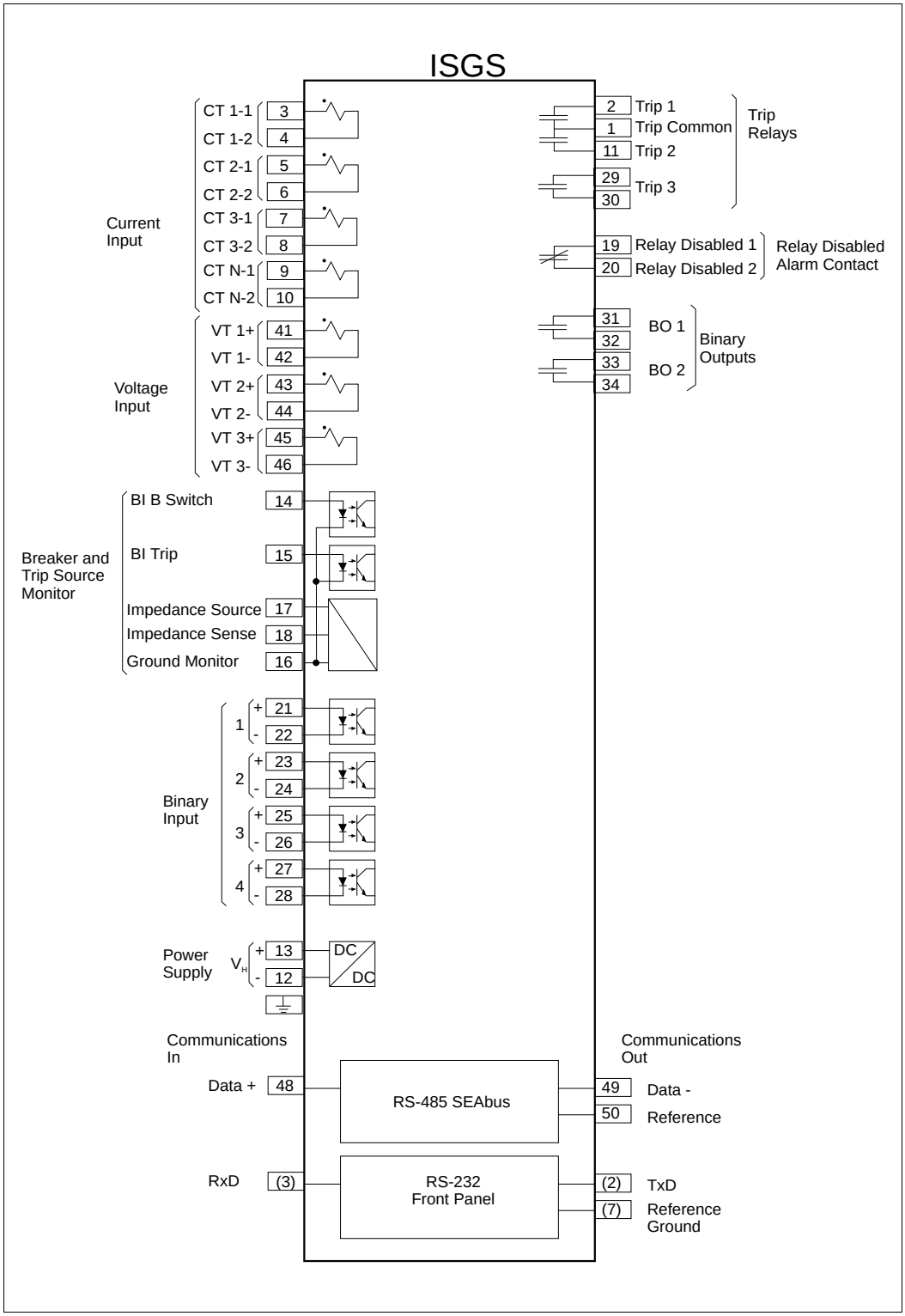


Figure 2.5 Internal Connections

Note: The relay disabled contact should be wired to plant-wide distributed control system or external alarm.

2.5 Communications

The ISGS relay must be connected to a host computer in order for it to communicate with other devices. The relay supports both RS-232 and RS-485 (optional) data interfaces. The use of either of these data interfaces will allow the same level of access to the system as the front panel keypad, but configuration through communications does not require a password.

The next section describes the connection to the interfaces. For more information about operating the ISGS relay via the data interfaces, refer to the documentation for the communications software, such as WinPM™ or Wisdom. Keypad operations are described in **Chapter 3**.

2.5.1 PC Communications (RS-232)

The RS-232 interface (front port) is intended only for short-term connections to a portable computer. Use this interface to perform initial setup or to read the ISGS relay data logs or waveform buffers using an appropriate software program. To connect your PC to the front port, follow these instructions:

1. Remove the relay case front cover.
2. Locate the RS-232 connector on the front panel of the cradle assembly.
3. Connect the PC to the front panel RS-232 port using a standard DB-9 serial port connection cable (DB-9 male to DB-9 female or DB-25 female depending on the type of port on the computer). This connection does not require the use of special adapters or a null-modem cable.

2.5.2 Network Communications (RS-485)

The optional RS-485 interface (rear port) allows remote communication over a shielded twisted pair wire at distances of up to 4000 feet. Use this interface together with an appropriate software program for remote monitoring and control of the ISGS relay.

To connect the ISGS relay to your communications system, follow these instructions:

1. Locate the RS-485 connector on the rear of the M1 case.
2. Use shielded twisted pair wire to connect pins 48, 49, and 50 to your electrical distribution system.

To connect the ISGS relay to your PC via the rear port

- *directly*, use an RS-232 to RS-485 converter.
- *via modem*, use an RS-232 to RS-485 converter and a null modem.

2.6 Cradle Assembly

Some of the setup and maintenance procedures in this manual require removal of the relay cradle assembly from the drawout case. Use the following instructions for the proper removal and insertion of the cradle assembly.

IMPORTANT:
The relay module contains CMOS circuits. Electrostatic discharges into or around the relay cradle or any of its components must be avoided. Use grounding straps or touch a grounded metal surface before handling the relay cradle.

2.6.1 Removing

Use the following procedure to remove the cradle assembly from the case:

1. Remove the relay case front cover.
2. Remove the top and bottom connecting plugs (paddles).
3. Loosen the cradle assembly by pulling the top release lever to the left and the bottom release lever to the right until the assembly ejects from the case.
4. Grasp the cradle assembly by the edges of the front panel and pull it out of the drawout case.
5. Place the cradle assembly on an anti-electrostatic surface and perform the desired work.

2.6.2 Inserting

Use the following procedure to insert the cradle assembly into the drawout case:

1. Insert the cradle assembly until the release levers come in contact with the protrusions on the case.
2. Position the top and bottom release levers until the slots on the levers align with the protrusions on the case.
3. Use the release levers to finish inserting the cradle assembly into the case. Apply pressure to the cradle assembly front panel until the assembly fully seats in the case.
4. Insert the top and bottom paddles.
5. Check for proper insertion of the cradle assembly by seeing if the expected measured values are observed on the relay display.
6. Install the front cover.

3 User Interface

Operation, parameter selection, and control of the ISGS relay are performed using the front panel controls and indicators. They consist of a 26-key membrane keypad, a 2-line by 16-character liquid crystal display (LCD), three light-emitting diodes (LEDs), and the front port.

3.1 Keypad

The relay can be controlled via the keypad, the front port, or the optional rear port. This manual covers only keypad operations. For information about communicating with the ISGS relay via the data ports, refer to the documentation supplied with the communications software (WinPM or Wisdom).

The ISGS relay keypad allows access to any relay information or function for display or parameter changes where applicable. The keypad consists of 26 keys. **Table 3.1** provides a detailed description of each key type.

To access relay information or functions for display or modification, use the **Arrow** keys to scroll through relay addresses or use the **Direct Addr** key and the specific address number to go directly to the information or function.

Use the **Double Arrow** keys to scroll through the address blocks and use the **Single Arrow** keys to scroll within an address block.

3.2 Indicators

The indicators on the front panel display consist of three LEDs and a two-line LCD.

3.2.1 LEDs

The LED indicators are used to provide general status information, which alerts the operator to an event or problem and prompts the operator to use the LCD to review the logs for more detailed information. The three LEDs and their functions are listed below.

LED	Color	Function
System	Green	Denotes the relay is operating properly (always on when relay is in service).
Pickup	Red	Denotes a protective function is in pickup.
Trip	Red	Denotes a protective function or remote command has initiated a trip.

Both the Pickup and the System LED operate automatically and do not require a reset.

- The System LED remains on as long as power is applied and the relay is functioning properly.
- The Pickup LED is illuminated as long as a protective function is in pickup.

Key	Name	Function
Pass word	Password	Accesses the password function, which is required for programming relay settings.
Direct Addr	Direct Addr	Allows direct entry of addresses.
Trip Log	Trip Log	Displays the trip log.
Target Reset	Target Reset	Resets the Trip LED.
⏫	Double Arrow	Scrolls through the address blocks.
▲	Single Arrow	Scrolls through the addresses within an address block.
F	F	Saves new settings when followed by **Enter**, enters or exits subaddress level, or switches to alternate parameter set when followed by 1 or 2 and **Enter**.
9	Numeric	Used to enter an address number after pressing **Direct Addr**, or to enter a numeric setting.
.	Decimal Point	Indicates a decimal point or the separation between month, day, and year, or between hours, minutes, and seconds.
+/-	Plus/Minus	Toggles between positive and negative values.
Back Space	Backspace	Deletes one character to the left or selects backwards.
∞	Infinity	Programs the setting to the highest possible value.
Enter	Enter	Chooses the setting option, enters a setting value, or confirms the address entered after pressing **Direct Addr.**
Yes	Yes	Accepts the displayed setting, or replies “yes” to the displayed prompt.
No	No	Rejects the displayed setting, allows entry of a numeric setting, replies “No” to the displayed prompt, or selects forward.

Table 3.1 Front Panel Keys

The Trip LED is illuminated until the **Target Reset** key is depressed. Reset the Trip LED by momentarily depressing the Target Reset key.

Note: If the Trip LED is on and power is removed, it will still be set to on when power is restored.

3.2.2 LCD

The two-line by sixteen-character LCD allows the viewing of parameters, measured data, and keypad entries. The LCD also displays messages returned by events such as a relay going into pickup.

Whenever a relay goes into pickup, in addition to lighting the pickup LED, the LCD shows a message that indicates which protection element is in pickup. A pickup message is displayed as follows:

```
PICKUP FFF Pxxxx
MM/DD hh:mm:ss
```

In this message

FFF — is the two or three character ANSI protection code number, for example, 50, or 50N.

xxxx — is a sequence of the characters 1, 2, 3, and/or N, indicating which phase or combination of phases and neutral have picked up.

MM/DD hh:mm:ss — is the date and time of the event.

These messages are displayed until superseded by another pickup, a trip message, a target reset, or a request by the operator to display other information.

3.3 Password Protection

A password should be used to prevent any accidental or unauthorized parameter changes. While relay information can be accessed for display without a password, all changes to parameter settings require a user password.

Note: The ISGS relay is not password protected when making parameter changes through Wisdom software.

The ISGS relay offers three password protected access levels:

Level 1 consists of simple settings such as all protective and setpoint settings that do not cause a reset. These simple settings include communications and time and date settings.

Level 2 consists of protective function settings such as CT and VT ratios, the changing of which can cause a device reset.

Level 3 includes additional access to all matrixing, the changing of which can cause a device reset.

Password configuration is described in **Section 9.4**.

To access any password protected information or function, either first enter the password (up to five digits) and then go to the desired address, or first access the address block and then enter the password as described in the following steps:

1. Press the **Password** key. The password dialog box appears.

```
Password:
```

2. Enter a password (00000 to 99999) using the number keys from the keypad. The LCD displays each digit entered as an @ symbol.

```
Password:
@@@@@
```

3. Press the **Enter** key after completing the entry.

4. If a correct password has been entered, the dialog box displays a confirmation message that depends on the level password that was entered.

```
Password:
User PW Three OK
```

   For a level 1 or level 2 password, the word “Three” in the illustration above would be replaced by “One” and “Two,” respectively.

   If the wrong password has been entered, the dialog box displays the following message:

```
Password:
Rejected
```

5. When the confirmation message appears, press the **Enter** key. This action returns the display that was in use before entering the password.

   For example, if the address block of the parameter to be changed was displayed prior to entering the password, the display returns to this address block and the device is ready to accept changes.

3.4 Menu

The ISGS relay menu (or memory map) is organized in a hierarchical structure that is made up of address blocks and addresses. The first level consists of address blocks. Each address block represents one complete function or two related functions and is identified by a unique four-digit number ending in two zeros (for example, 1500). Refer to **Figure 3.1**.

The second level consists of individual addresses confined to an address block. Each address represents a part of a function—the changeable parameter—or the measured value of a displayed parameter. The parameter is identified by a unique four-digit number that consists of the first two digits of the address block and two digits indicating the parameter's number within the address block (for example, 1502). Refer to **Figure 3.1**.

Block	Function	Address	Parameter
A1500	Instantaneous Phase Overcurrent (50)	1501 1502 1504 1510 1511 1512	Function 50 Pickup 50 Delay 50 Freeze Wfm 1 50 Freeze Wfm 2 50 Block 50
	High-Set Instantaneous Phase Overcurrent (50HS)	1551 1552 1560 1561	Function 50HS Pickup 50HS Freeze Wfm 1 HS Freeze Wfm 2 HS
A1900	Directional Phase Time Overcurrent (67)	1901 1902 1903 1905 1906 1907 1908 1910 1911	Function Curve Pickup Time Dial Filter Impedance Direction Freeze Wfm 1 Freeze Wfm 2
A2200	Overvoltage (59)	---	---

Figure 3.1 Example of Menu Structure Displaying Address Blocks with Two Related Functions, an Individual Function, and an Unavailable Function.

A complete ISGS relay menu with parameter listing is provided in **Appendix C**. The various parameter settings are shown in the respective section describing the complete function.

Only certain protective function parameters have two settings. All A settings are grouped under parameter set A, and all B settings are grouped under parameter set B. Each parameter set automatically includes all the regular parameters that can be programmed to only one setting at a time and, therefore, apply to both sets. Examples are protective function enable settings and matrixed output contacts such as waveform buffers and blocking. For more information on parameter sets, refer to **Section 6.11**.

The LCD identifies functions that include parameters configurable for A and B settings by preceding the function's address block number with the letter A or the letter B, depending on which parameter set is currently displayed. Refer to **Figure 3.2**.

Figure 3.2 LCD Display of a Function that Includes Parameters Configurable for A and B Settings.

In addition, when scrolling through the individual parameters of an ISGS relay, the LCD identifies each parameter that is configurable for A and B settings by preceding the parameter's address number with the letter A or the letter B, depending on which parameter set is currently displayed. Refer to **Figure 3.3**

Figure 3.3 LCD Display of a Parameter that is Configurable for A and B Settings

When accessing the ISGS relay menu through the keypad, the **Arrow** keys allow scrolling through all available functions and parameters. If an option is not installed, the LCD only displays the address block that is reserved for this option. In this case, second level addresses are not available.

3.5 Standard Operating Procedures

Before attempting to display or configure any of the relay data, ensure that the relay has control power which is indicated by the system LED (green) being lit.

The steps for displaying data, configuring parameters, saving data, and switching to the alternate parameter set for either display or configuration are described in detail in **Table 3.1, Standard Operating Procedures**.

⚠ WARNING

Unprotected system during reconfiguration.

If fault occurs during reconfiguration, can result in death, severe personal injury, or equipment damage.

Do not change device configuration or matrixing while the relay is in service.

Before changing device configuration, open the associated switching device and remove from service.

When the configuration or matrixing is changed, the relay may require up to 60 seconds to re-initialize and does not provide protection for the power system during the re-initialization time period.

Displaying function names (address blocks), parameter names and their settings or values (addresses), and subparameter settings (subaddress, where applicable), does not require a password (except for viewing the password itself). Data can be displayed by following steps 1 to 3 of the standard operating procedures described in **Table 3.1**. Viewing passwords requires the entry of an appropriate level user password (refer to **Section 3.3** for more information on passwords).

Configuring parameters requires a password. Use steps 1 and 2 or steps 1 to 3 to display the desired parameter or its subparameters. Continue with step 4 to make changes to this parameter or subparameter.

When leaving a function or before scrolling to the waveform parameters of the same function, the relay prompts to indicate the end of the password operation and whether the changes made so far shall be saved. When the message “End of Password Operation ?” appears, press the **Yes** key to continue to the next function. Press the **No** key to scroll back through the parameters of this one function. Pressing the **Yes** key returns the message “SAVE NEW SETTINGS ?”. Press the **Yes** key again to save the settings, or press the **No** key to abort any changes made after the last saving procedure.

Table 3.1 Standard Operating Procedures

Step	Task	Description
		Display Data
1	Display data at Address Block (xx00)	Use **Double Arrow** keys to scroll forward or backward between address blocks. **OR** Press **Direct Addr** key; enter address of desired address block using the numeric keypad; press **Enter** key. To view passwords, carry out step 4 before continuing with the next step.
2	Display data at Address (xxxx)	Use **Single Arrow** keys to scroll forward or backward between parameter addresses. Skip step 3 if function has no subaddresses. **OR** Press **Direct Addr** key; enter address of desired parameter using the numeric keypad; press **Enter** key. Skip step 3 if function has no subaddresses.
3	Display data at Subaddress (0xx)	Press **F** key once to enter subaddress level; use **Single Arrow** keys to scroll forward or backward between subaddresses. Press **F** key again to return to address level.
		Configure Parameters
4	Enter Password	Press **Password** key; enter the password; press **Enter** key twice to return to screen displayed last before password entry. Leaving an address block, leaving a function within an address block, or before scrolling to the waveform parameters within a function prompts for renewed password entry. For password levels, proper password entry, and display messages, refer to **Section 3.3**.
5	Configure at Address (xxxx)	Display cursor is blinking (otherwise repeat step 4). Change displayed value by entering a new value using the keypad. Press **Enter** key. Change displayed selection by pressing the **No** key to scroll forward through options until desired option appears. Press **Enter** key. Skip step 6 if function has no subaddresses.
6	Configure at Subaddress (0xx)	Press **F** key once to enter subaddress level; use **Single Arrow** keys to scroll forward or backward between subaddresses. Change displayed selection by pressing **No** key to scroll forward through options until desired option appears. Press **Enter** key. Press **F** key again to return to address level.
		Save Changes
7	Enter Save Procedure	Press **F** key. At the blinking cursor position, the letter F is displayed. Press **Enter** key. Message “SAVE NEW SETTINGS?” appears.
	Undo Changes	To abort any changes made, press **No** key. After message “SAVING PROCEDURE ABORTED” appears, press **Enter** key to return to screen displayed last before aborting settings. Settings can be undone any time while still in the same function by simply returning to the parameter and assigning a new value.
	Save Changes	To save settings and reset relay to new parameters, press **Yes** key followed by **Enter** key. After message “NEW SETTINGS SAVED” appears, press **Enter** key to return to screen displayed last before saving settings. Leaving an address block, leaving a function within an address block, or before scrolling to the waveform parameters within a function prompts for the saving of the function settings.
		Switch Parameter Set
8	Switch Parameter Set	Press **F** key followed by either “1” (for normal settings) or “2” (for alternate settings) on the numeric keypad. The message “PARAMETER SET COPIED TO EDIT” appears. Press **Enter** key.
9	Display/Configure Alternate Parameter Set	Display shows address block (“xx00”) with either “A” or “B” prefix in address (“Axx00” or “Bxx00”). “A” indicates parameter set 1; “B” indicates parameter set 2. Repeat steps 1 to 3 or steps 1 to 7 to display or configure the alternate parameter set.

Notes:

3

4 Hardware Configuration

This chapter explains the device startup and how to configure the basic ISGS relay parameters. The relay must be configured with certain system parameters, such as phase sequence and frequency. In addition, information regarding the manner in which the ISGS relay is connected in the installation must be configured.

All parameter changes require a password. Refer to **Section 3.3** for instructions on how to enter your password. Viewing parameter settings does not require a password.

Note: The ISGS relay is not password protected when making parameter changes through Wisdom software.

Perform parameter changes using steps 1 through 9 of the standard operating procedure described in **Section 3.5**.

4.1 Startup

Block	Function	Address	Parameter
0000	Power On/ Configuration Display	---	---

This section describes the content of address block 0000 represented by the initial Power On display and the initial Power On Meter display.

When the relay is powered on, following a brief hardware initialization check, the green System LED illuminates and the LCD shows the contents of address 0000. First, the Power On display indicates your relay configuration. After approximately five seconds, the Power On display is replaced by the Power On Meter display showing two values. Prior to placing the relay in service, verify that the correct relay configuration was preloaded at the factory. To return to the Power On display, press the **Direct Addr** key and key in 0000 followed by the **Enter** key.

4.1.1 Power On Display

The two lines of the Power On display indicate your relay configuration. Line 1 contains the function address 0000 and the relay's firmware version. Line 2 identifies the relay's catalog number which depends on the options you ordered with your relay (see **Figure 4.2** for catalog numbers).

Reading from left to right in **Figure 4.1**, line 1 shows the address block 0000 and the ISGS firmware version ISGS-3V3.00. Line 2 displays the catalog number D553100VSDF00000. The first character of this number, *D*, indicates a 120 VAC power supply, the fourth character, *3*, voltage inputs for energy metering, and the eighth through eleventh characters, *VSDF*, indicate Under/Overvoltage protection, Negative Sequence Voltage protection, Directional Overcurrent protection, and Under/Overfrequency protection, respectively.

Figure 4.1 Power On Display

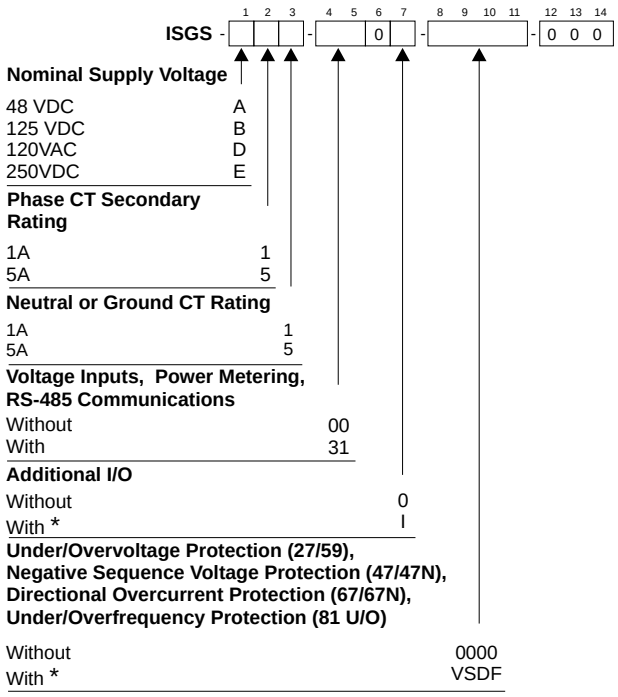


Figure 4.2 Relay Configuration (Catalog Number)

4.1.2 Power On Meter Display

The Power On Meter display consists of two measured values. The default setting for Line 1 displays average current, and Line 2 shows average current demand. The type of default values displayed can be changed in address block 7000, Operating Parameters, described in **Chapter 7**.

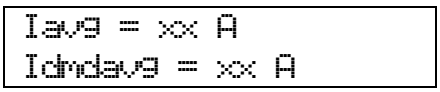


Figure 4.3 Power On Meter Display

The Power On Meter display is replaced with other information anytime an event message is displayed or the LCD is used to set parameters or check logs. To return the LCD to the Power On Meter Display, press the **Trip Log** key followed by the **Target Reset** key.

4.2 Device Configuration

The Device Configuration function allows you to set up the ISGS relay to match line frequency, phase sequence, and breaker connection settings of your system.

⚠ WARNING

Unprotected system during reconfiguration.

If fault occurs during reconfiguration, can result in death, severe personal injury, or equipment damage.

Do not change device configuration or matrixing while the relay is in service.

Before changing device configuration, open the associated switching device and remove from service.

When the configuration or matrixing is changed, the relay may require up to 60 seconds to re-initialize and does not provide protection for the power system during the re-initialization time period.

1000	Device Configuration	
Address	**Parameter**	**Options**
1002	Frequency	50Hz or 60Hz
1003	Phase Sequence	123 (ABC) or 132 (ACB)
1004	Breaker Connection	Trip 1, Trip 2, Trip 3, Trip 1 & 2, Trip 1 & 3, Trip 2 & 3, or Trip 1 & 2 & 3
1005	Trip Time	0.01-32.00 s (0.01 s steps)

The frequency parameter (1002) must be set to the nominal frequency of your system. Phase sequence (1003) selects the phase sequence of your system as it enters the ISGS relay. The breaker connection parameter (1004) selects the trip contact that your breaker is connected to. Many functions use this parameter to determine if the device is attempting to open the breaker. Breaker failure can be initiated by either one of the three trips (if the Breaker Failure function is enabled). The default is set to Trip 1.

4.3 Setting Binary Input Voltages

Binary inputs are jumpered to correspond to the auxiliary supply voltage of the relay in which they are installed. The inputs will correctly respond to DC or AC depending on the jumpering. The jumpers can be placed to allow the inputs to work with any of the available voltages, independent of the auxiliary supply voltage. Refer to **Figure 4.5** and **Table 4.1**.

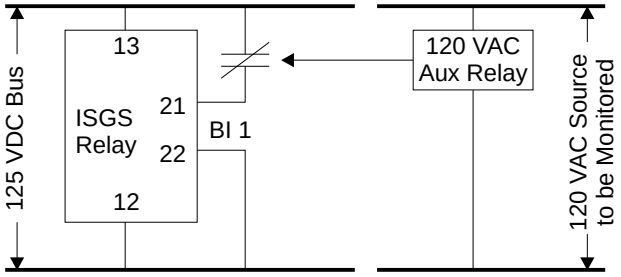


Figure 4.4 Binary Inputs Independent of Supply Voltage

Table 4.1 lists the possible jumper positions for setting binary input voltages. The numbers in this table each refer to a pin from and to which a jumper can be moved.

Table 4.1 Jumper Positions

Voltage Supply	BI 1 Terminals 21/22	BI 2 Terminals 23/22	BI 3 Terminals 25/26	BI 4 Terminals 27/28
48 V	X111-X112	X23-X22	X34-X35	X46-X47
	X13-X14	X25-X26	X37-X38	X49-X50
	X16-X17	X28-X29	X40-X41	X52-X53
	X19-X20	X31-X32	X43-X44	X55-X56
125 V (Default)	**X111-X112**	**X23-X22**	**X34-X35**	**X46-X47**
	X13-X14	**X25-X26**	**X37-X38**	**X49-X50**
	X17-X18	**X29-X30**	**X41-X42**	**X53-X54**
	X19-X20	**X31-X32**	**X43-X44**	**X55-X56**
120 VAC	X110-X111	X24-X23	X35-X36	X47-X48
	X14-X15	X26-X27	X38-X39	X50-X51
	X17-X18	X29-X30	X41-X42	X53-X54
	X20-X21	X32-X33	X44-X45	X56-X57
250 VDC	X111-X112	X23-X22	X34-X35	X46-X47
	X14-X15	X26-X27	X38-X39	X50-X51
	X17-X18	X29-X30	X41-X42	X53-X54
	X19-X20	X31-X32	X43-X44	X55-X56

Figure 4.5 shows option board 2 and its jumpers. The drawing indicates the jumpers associated with each binary input. The enlarged set of pins shows an example of pin labeling and a jumper at location X17-X18.

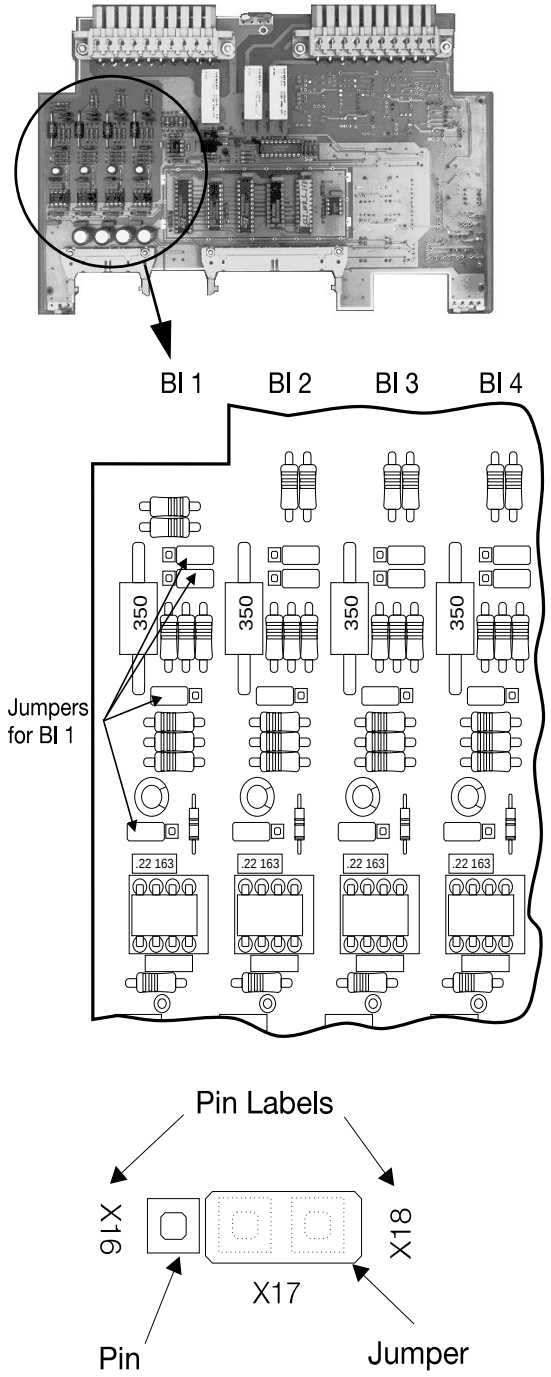


Figure 4.5 Option Board 2 with Binary Inputs

Changing Jumper Positions

IMPORTANT:
The relay module contains CAMS circuits. Electrostatic discharges into or around the relay cradle or any of its components must be avoided. Use grounding straps or touch a grounded metal surface before handling the relay cradle.

1. Remove the cradle assembly from the case as described in **Section 2.6.1**.
2. Set the relay on its back.
3. With a small screwdriver, remove the four screws (on the sides of the relay) that hold the front panel to the relay cradle.
4. Lift the front panel and hang it in the slots provided on the left side of the casing. Take care not to damage the ribbon cables that connect the electronics in the cradle to the front panel electronics.
5. Disconnect the two ribbon cables from the main board and the option board 2. The main board is the center board which is screwed to the option board 2 on its right.
6. Withdraw these two attached boards and set them on the workplace with the jumper side up (see **Figure 4.5**).
7. Each jumper is pushed over two out of three pins. Each pin is labeled with numbers identical to those in **Table 4.1**. The numbers of two side-by-side pins represent a possible jumper position.
8. With a small needle nose pliers, lift the desired jumper off of its pins and push it down over another two pins of the same set.

   Example: In **Figure 4.5**, the jumper is over pins X17 and X18, a default setting for a 125 V power supply. For a 48 V power supply, set this jumper to X16-X17.

   Repeat this step until all desired jumpers are repositioned.
9. Insert the attached boards back into the cradle. The connectors of each board must snap into the terminals of the casing.
10. Reattach the two ribbon cables to the main board and the option board 2.
11. Unhook the front panel and carefully place it over the cradle. Lift the front panel slightly to make sure that the ribbon cables connected to the front panel are positioned in their assigned space to prevent damage.
12. Insert and tighten the four front panel screws.
13. Insert the cradle into the casing as described in **Section 2.6.2**.

4.4 CT Configuration

The CT Configuration function allows you to set up the ISGS relay to match the phase CT primary rating, the neutral or ground CT primary rating, and the CT input's normal power flow setting of your system. For CT connections refer to **Figure 4.8**.

⚠ WARNING

Unprotected system during reconfiguration.

If fault occurs during reconfiguration, can result in death, severe personal injury, or equipment damage.

Do not change device configuration or matrixing while the relay is in service.

Before changing device configuration, open the associated switching device and remove from service.

When the configuration or matrixing is changed, the relay may require up to 60 seconds to re-initialize and does not provide protection for the power system during the re-initialization time period.

1100	CT Configuration	
Address	**Parameter**	**Options**
1101	Phase CT Primary Rating	5-8000 A (1 A steps)
1102	Neutral or Ground CT Primary Rating	5-8000 A (1 A steps)
1104	Power Flow	Normal or Reverse

The phase (1101) and neutral/ground (1102) CT primary ratings are independently configurable. However, when a residual sensing method is used for ground fault protection, the primary current ratings for the neutral CT and the phase CT must be equal. The CT secondary ratings (1A or 5A) are set at the factory and are not changeable from the front panel.

Power flow is also referred to as top feed or bottom feed. If the power enters the polarity mark on the CTs, set the Power Flow parameter (1104) to *Normal*. If power leaves the polarity mark, enter *Reverse*. **Figure 4.6** illustrates examples of normal and reverse power flow.

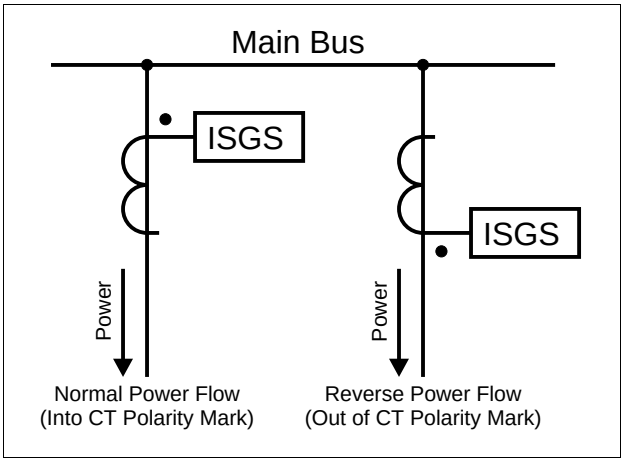


Figure 4.6 Normal/Reverse Power Flow

4.5 VT Configuration

Use this address block to configure the ISGS relay to match the VT primary rating and the VT connection setting for your system. These settings are available only if the voltage input option is installed on the relay.

⚠ WARNING

Unprotected system during reconfiguration.

If fault occurs during reconfiguration, can result in death, severe personal injury, or equipment damage.

Do not change device configuration or matrixing while the relay is in service.

Before changing device configuration, open the associated switching device and remove from service.

When the configuration or matrixing is changed, the relay may require up to 60 seconds to re-initialize and does not provide protection for the power system during the re-initialization time period.

1200	VT Configuration	
Address	**Parameter**	**Options**
1201	Primary Rating	120-138,000 V (1 V steps)
1202	VT Connect	Line-to-Line or Line-to-Neutral
1203	Sec. VT Rating	100-120 V (1 V steps)

Voltage transformers may be connected in either of two ways:

- Two VTs connected open delta-open delta
- Three VTs connected wye-wye

For brevity, the open delta connection is referred to as L-L (line-to-line), while the wye connection is referred to as L-N (line-to-neutral). Wye-delta or delta-wye connection of VTs is not allowed. **Figure 4.7** shows the correct VT connections and polarities.

Voltage transformers are specified with an input to output voltage ratio (for example, 12000:120). The secondary voltage rating of the VTs can be set by the Secondary Voltage Rating parameter (1203).

Before leaving the hardware configuration blocks, (only when changing parameters, not when viewing) the ISGS relay displays the message “END OF PASSWORD OPERATION?”. Press the **No** button to return to one of the configuration blocks. The message “PRESS ANY KEY TO CONTINUE” appears. Press any key to return to the screen displayed last before the message prompt appeared. Press the **Yes** button if you are finished with the configuration changes. The device prompts you to save the settings.

- Press the **Yes** button to save the settings. The relay resets and displays the Power On and Power Meter On displays.
- Press the **No** button if you do not want to save the changes The message “SAVING PROCEDURE ABORTED” appears. Press **Enter** to return to the last address block.

Note: For CT configuration, CTs on the neutral must be the same rating as other CTs for residual ground sensing, directional neutral sensing, or direct ground sensing.

For VT connections, VTs must be either wye-wye or delta-delta. Wye-delta or delta-wye connections are not permissible.

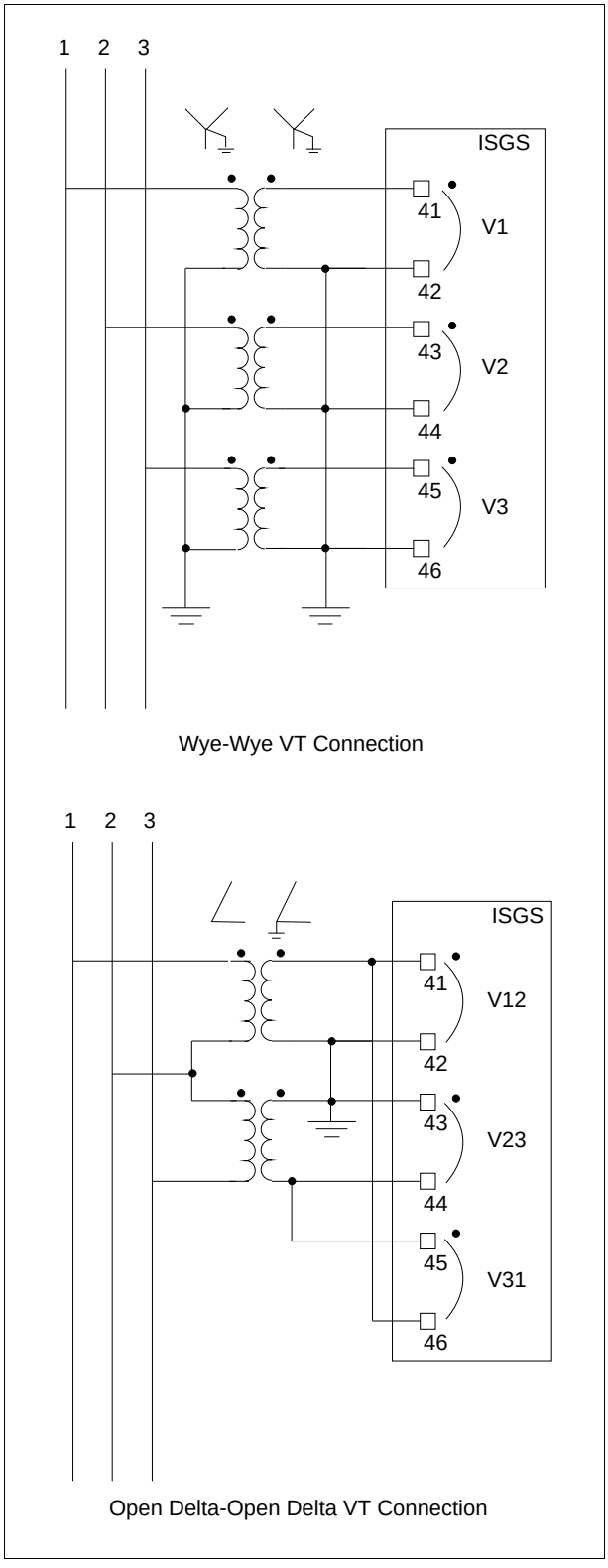


Figure 4.7 Voltage Transformer Connections

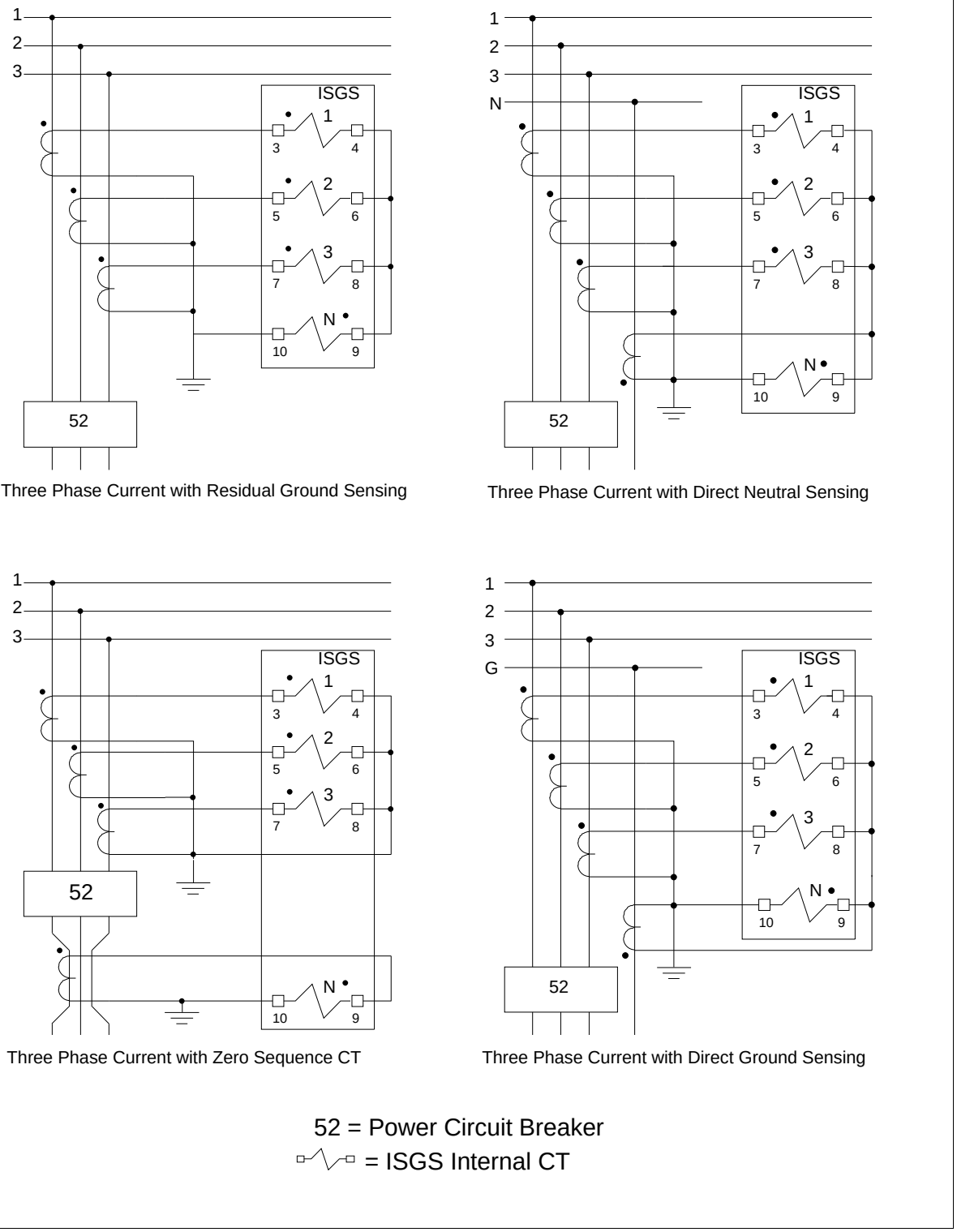


Figure 4.8 Current Transformer Configuration

5 Protective Function Configuration

5.1 Overview

This chapter explains how to set the parameters for the protective functions of the ISGS relay.

Password
All parameter changes require a password. Refer to **Section 3.3** on how to enter your password. Viewing parameter settings does not require a password.

> **Note:** The ISGS relay is not password protected when making parameter changes through Wisdom software.

Configuration Steps
Perform parameter changes using steps 1 through 9 of the standard operating procedures described in **Section 3.5**.

Parameter Sets
Many protective functions can be set to two different parameter sets—set A and set B. These functions are indicated by the letter *A* or *B* preceding the address block number. Alternate sets are useful for seasonal settings or for special operating periods. Either set can be selected (in address block 7100) to be the active set that controls the relay operation. The parameters for both sets are entered in the relevant address blocks. Waveform capture buffer settings apply to both parameter sets. Unless you do not desire an alternate set, configure both sets when configuring the relay.

> **Note:** The settings for parameter sets A and B are entered in the address block. However, the parameter set which the ISGS relay is actively using is selected at address block 7100. Refer to **Section 6.11** for discussion of parameter sets.

Actions on Pickup or Trip
Protective functions can be set to have actions occur on pickup or on trip. Binary outputs can be set to be actuated on pickup of a protective function. A protective function is set to trip a breaker by assigning the trip contact that is connected to the breaker (default is Trip 1). Binary outputs can also be assigned to trip a breaker. It is possible, however to have a protective function enabled and not assigned to any output. Events and their sequences are entered in the trip log as usual, but the breaker will not be affected. This setting is useful for monitoring and alarming without tripping, and for waveform capture. For more information on the control of inputs and outputs, refer to **Chapter 6**.

Pickup
When testing induction disk relays, an established practice is to set the pickup value to 1.0 A of secondary CT output. The time overcurrent curves will show a pickup, but the relay will not trip in a predefined repeatable manner until it reaches 1.3 to 1.5 A. With numerical relays like the ISGS, however, a sustained pickup indication means definite operation. To account for measurement inaccuracies, and to guarantee that the relay will never trip at 100% of pickup or below, the pickup point is set at 106% of the pickup setting to avoid any unintended nuisance trips.

Neutral or Ground
The availability of protective functions for neutral or ground depends on how the external CTs are connected. If a ground or zero-sequence CT is used and connected to the fourth internal CT, the ground or neutral protective function is a ground function. If the fourth CT is connected in the common return of the other three internal CTs (residual), the function is indicated as being neutral. There does not need to be an explicit selection of neutral or ground.

Custom Curve
The custom curve is one user-defined curve that can be used by one or more protective functions that have the custom curve option in the curve list.

Wisdom Software
While the ISGS relay protective functions can be completely configured manually using the LCD and the keypad, Wisdom software allows faster and easier configuration when it is used on a PC connected to either data port. For data port connections refer to **Section 2.5**.

5.2 Instantaneous Phase Overcurrent (50)

The Instantaneous Phase Overcurrent function consists of a phase instantaneous overcurrent function and an adjustable delay. This function begins timing when any individual phase current exceeds the pickup at 100% of set pickup point and drops out at 95% of the pickup point.

A1500	Instantaneous Phase Overcurrent (50)	
Address	**Parameter**	**Option**
1501	Function	Enabled or Disabled
1502	Pickup	5 A CTs: 1-120 A 1 A CTs: 0.2-24 A (0.1 A steps)
1504	Time Delay	0-60 s (0.01 s steps)
1510	Freeze Wfm1	on Pickup, on Trip, or None
1511	Freeze Wfm2	on Pickup, on Trip, or None
1512	Blocked by	None, 50HS & 50HSN, 50 HSN, or 50HS

The function can be enabled or disabled (1501).

The range of the pickup value (1502) depends on the secondary phase CT rating (1 A or 5 A), and the value is in secondary amperes.

The time delay (1504) represents the time between pickup and trip and can be adjusted from 0 to 60 seconds in steps of 0.1 second. If the function remains in pickup for longer than the time delay, the function causes a trip. The delay can also be set to infinity so that the function never times out.

Each of the two waveform capture buffers (1510 and 1511) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.3 High-Set Instantaneous Phase Overcurrent (50HS)

The High-Set Instantaneous Phase Overcurrent function causes an undelayed trip when any individual measured phase current exceeds the preprogrammed threshold (pickup value). The relay will trip at 100% of the set pickup point.

A1500	High-Set Instantaneous Phase Overcurrent (50HS)	
Address	**Parameter**	**Option**
1551	Function	Enabled or Disabled
1552	Pickup	5A CTs: 5-120 A or 1A CTs: 0.2-24 A (0.1 A steps)
1560	Freeze Wfm1	on Trip, or None
1561	Freeze Wfm2	on Trip, or None

The function can be enabled or disabled (1551). The range of the pickup value (1552) depends on the secondary phase CT rating (1 A or 5 A) and the value is in secondary amperes.

Each of the two waveform capture buffers (1560 and 1561) can be independently programmed to freeze snapshots on trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.4 Instantaneous Neutral or Ground Overcurrent (50N)

The Instantaneous Neutral or Ground Overcurrent function has an adjustable delay whose input is the current measured by the neutral CT. It begins timing when the neutral or ground current exceeds the pickup value. The ISGS relay will pickup at 100% of set pickup point and drop out at 95% of the pickup point.

A1600	Instantaneous Neutral or Ground Overcurrent (50N)	
Address	**Parameter**	**Option**
1601	Function	Enabled or Disabled
1602	Pickup	5 A CTs: 1-120 A or 1 A CTs: 0.2-24 A (0.1 A steps)
1604	Time Delay	0-60 s (0.01 s steps)
1610	Freeze Wfm1	on Pickup, on Trip, or None
1611	Freeze Wfm2	on Pickup, on Trip, or None
1612	Blocked by	None, 50HS & 50HSN, 50HSN, or 50HS

The Instantaneous Neutral or Ground Overcurrent function can be enabled or disabled (1601). The form of protection provided depends on the manner in which the external CTs are connected to the ISGS relay. **Figure 4.5** in **Chapter 4** shows correct CT connections and polarities.

The range of the pickup value (1602) depends on the secondary neutral CT rating (1 A or 5 A) and the value is in secondary amperes.

The time delay (1604) represents the time between pickup and trip and can be adjusted from 0 to 60 seconds in steps of 0.1 second. If the function remains in pickup for longer than the time delay, this parameter causes a trip. The delay can also be set to infinity so that the function never times out.

Each of the two waveform capture buffers (1610 and 1611) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.5 High-Set Instantaneous Neutral or Ground Overcurrent (50HSN)

The High-Set Instantaneous Neutral or Ground Overcurrent function causes an undelayed trip when any individual measured phase current exceeds the preprogrammed threshold (pickup value). The relay will trip at 100% of the set pickup point.

A1600	High-Set Instantaneous Neutral or Ground Overcurrent (50HSN)	
Address	**Parameter**	**Option**
1651	Function	Enabled or Disabled
1652	Pickup	5 A CTs: 5-120 A or 1 A CTs: 0.2-24 A (0.1 A steps)
1660	Freeze Wfm1	on Trip, or None
1661	Freeze Wfm2	on Trip, or None

The High-Set Instantaneous Neutral or Ground Overcurrent function can be enabled or disabled (1651).

The range of the pickup value (1652) depends on the secondary phase CT rating (1 A or 5 A) and the value is in secondary amperes.

Each of the two waveform capture buffers (1660 and 1661) can be independently programmed to freeze snapshots on trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.6 Phase Time Overcurrent (51)

The Phase Time Overcurrent function uses a selected time overcurrent characteristic curve to determine the trip time for the applied phase currents. The defined characteristic curves are valid over a range of *multiple of pickup values*. The function also includes the ability to select a customer defined curve. This function is always enabled. Refer to **Appendix A** for detailed trip curve information.

A1700	Phase Time Overvurrent (51)	
Address	**Parameter**	**Option**
1702	Curve	Inverse Short Inverse Long Inverse Moderately Inverse Custom Very Inverse Extremely Inverse Definite Inverse Slightly Inverse I^2T Without Limit
1703	Pickup	5 A CTs: 0.5-20 A or 1 A CTs: 0.1-4 A (0.1 A steps)
1705	Time Dial	0.1-9.9 (0.1 steps)
1706	Filter	rms or fundamental
1709	Reset	Instantaneous or Disk Emulation
1710	Freeze Wfm1	on Pickup, on Trip, or None
1711	Freeze Wfm2	on Pickup, on Trip, or None
1712	Blocked by	None, 50HS, 50HSN, or 50HS & 50 HSN

The Curve parameter (1702) allows the selection of the pre-programmed characteristic curve used by this function. The ISGS relay comes with nine standard and one custom over-current characteristic curves that can be adjusted with the Time Dial parameter. The custom curve is a user-definable protective curve that integrates with instantaneous reset. The lower limit of the custom curve is 1.10. The maximum time to trip is the time at 1.10.

The range of the pickup value (1703) depends on the secondary phase CT rating (1 A or 5 A) and the value is in secondary amperes. The function begins timing when any individual phase current exceeds the pickup current setting.

Note: The pickup point is 1.06 of the pickup setting. Refer also to paragraph on **Pickup** in **Section 5.1**.

The Time Dial parameter (1705) used for the selected curve allows the time-to-trip of the curve to be raised or lowered The dial can be adjusted from 0.1 to 9.9 in steps of 0.1.

The Filter parameter (1706) sets the sensing method used by the function in its pickup calculations. The rms filter uses fundamental current plus harmonics, while the fundamental filter ignores harmonics.

The Reset parameter (1709) offers instantaneous or disk emulation settings. Selecting Instantaneous causes the relay to clear the timer when the current drops below the pickup threshold. Selecting Disk Emulation causes the relay to simulate the integrating disk characteristics of electromechanical relays, where the delay time decays over time. With disk emulation, a relay that continuously picks up and drops out will eventually trip. Set this parameter to Instantaneous when using a custom curve.

Each of the two waveform capture buffers (1710 and 1711) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.7 Neutral Time Overcurrent (51N)

The Neutral Time Overcurrent function uses a selected time overcurrent characteristic curve to determine the trip time for the applied current at the fourth current input. The defined characteristic curves are valid over a range of *multiple of pickup values*. The function also includes a customer defined curve. Refer to **Appendix A** for detailed trip curve information.

A1800	Neutral Time Overcurrent (51N)	
Address	**Parameter**	**Option**
1801	Function	Enabled or Disabled
1802	Curve	Inverse Short Inverse Long Inverse Moderately Inverse Custom Very Inverse Extremely Inverse Definite Inverse Slightly Inverse I^2T Without Limit
1803	Pickup	5 A CTs: 0.5-20 A or 1 A CTs: 0.1-4 A (0.1 A steps)
1805	Time Dial	0.1-9.9 (0.1 steps)
1806	Filter	rms or fundamental
1809	Reset	Instantaneous or Disk Emulation
1810	Freeze Wfm1	on Pickup, on Trip, or None
1811	Freeze Wfm2	on Pickup, on Trip, or None
1812	Blocked by	None, 50HS, 50HSN, or 50HS & 50 HSN

The Neutral or Ground Time Overcurrent function can be enabled and disabled (1801).

The Curve parameter (1702) allows the selection of the pre-programmed characteristic curve used by this function. The ISGS relay comes with nine standard and one custom over-current characteristic curves that can be adjusted with the Time Dial parameter. The custom curve is a user-definable

protective curve that integrates with instantaneous reset. The lower limit of the custom curve is 1.10. The maximum time to trip is the time at 1.10.

The range of the pickup value (1803) depends on the secondary phase CT rating (1 A or 5 A) and the value is in secondary amperes.

The Time Dial parameter (1805) used for the selected curve allows the time-to-trip of the curve to be raised or lowered. The dial can be adjusted from 0.1 to 9.9 in steps of 0.1.

The Filter parameter (1806) sets the sensing method used by the function in its pickup calculations. The rms filter uses fundamental current plus harmonics, while the fundamental filter ignores harmonics.

The Reset parameter (1709) offers instantaneous or disk emulation settings. Selecting Instantaneous causes the relay to clear the timer when the current drops below the pickup threshold. Selecting Disk Emulation causes the relay to simulate the integrating disk characteristics of electromechanical relays, where the delay time decays over time. With disk emulation, a relay that continuously picks up and drops out will eventually trip. Set this parameter to Instantaneous when using a custom curve.

Each of the two waveform capture buffers (1810 and 1811) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.8 Blocking Capability for Breaker or Interrupter Saving

High-set instantaneous phase overcurrent (50HS) and high-set instantaneous neutral or ground overcurrent (50HSN) functions have the capability to block 50, 51, 50N, and 51N selectively to prevent opening an interrupting device should the fault current exceed the rating of the device.

This function is used to keep an electrically-operated load break switch, recloser, or aging circuit breaker from attempting to interrupt current beyond its capability or rating. It must be used in conjunction with a slight delay (25 ms) in 50 so that 50HS can pickup or trip before 50 times out and trips. Should these parameters be set, a fault large enough to cause 50HS to pickup or trip before 50 has timed out will prevent 50 and/or 51, 50N, and 51N from tripping.

50HS/N can also be matrixed to an output contact to block differential tripping of a transformer differential relay when a fault is between the interrupter and the high side (bushings) of the transformer.

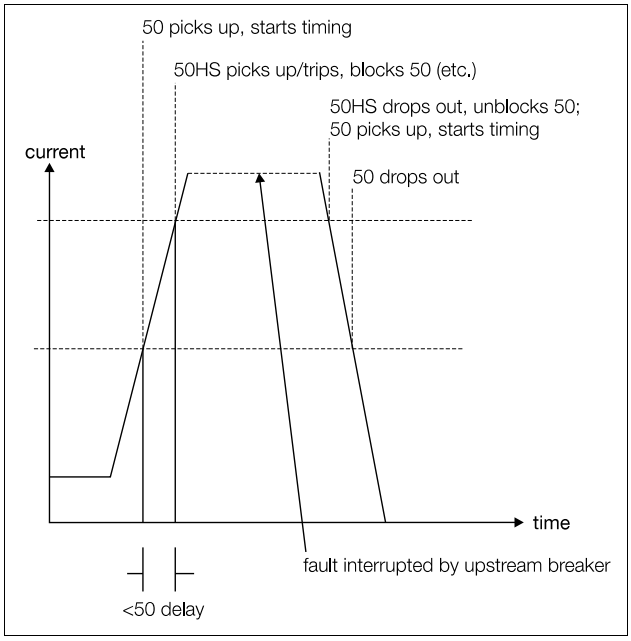


Figure 5.1 Blocking Capability Diagram

5.9 Directional Phase Time Overcurrent (67)

The Directional Phase Time Overcurrent function uses a selected time overcurrent characteristic curve to determine the trip time for the applied phase currents, utilizing the voltages present on the VTs to determine current direction. The defined characteristic curves are valid over a range of *multiple of pickup values*. The function also includes a customer defined curve. Refer to **Appendix A** for detailed trip curve information. This function is only available if the voltage input option is installed.

A1900	**Directional Phase Time Overcurrent (67)**	
Address	**Parameter**	**Option**
1901	Function	Enabled or Disabled
1902	Curve	Inverse Short Inverse Long Inverse Moderately Inverse Custom Very Inverse Extremely Inverse Slightly Inverse Definite Inverse I^2T Without Limit
1903	Pickup	5 A CTs: 0.5-20 A or 1 A CTs: 0.1-4 A (0.1 A steps)
1905	Time Dial	0.1-9.9 (0.1 steps)
1906	Filter	rms or fundamental
1907	Impedance	0-90°
1908	Direction	Forward or Reverse
1910	Freeze Wfm 1	on Pickup, on Trip, or None
1911	Freeze Wfm 2	on Pickup, on Trip, or None

The Directional Phase Time Overcurrent function can be enabled or disabled (1901).

The Curve parameter (1902) allows the selection of the pre-programmed characteristic curve used by this function. The ISGS relay comes with nine standard overcurrent characteristic curves that can be adjusted with the Time Dial parameter. The custom curve is a user-definable protective curve that integrates with instantaneous reset. The lower limit of the custom curve is 1.10. The maximum time to trip is the time at 1.10.

The range of the pickup value (1903) depends on the secondary phase CT rating (1 A or 5 A) and the value is in secondary amperes. The function begins timing when any individual phase current exceeds the pickup current setting.

The Time Dial parameter (1905) used for the selected curve allows the time-to-trip of the curve to be raised or lowered The dial can be adjusted from 0.1 to 9.9 in steps of 0.1.

The Filter parameter (1906) sets the sensing method used by the function in its pickup calculations. The rms filter uses fundamental current plus harmonics, while the fundamental filter ignores harmonics.

Impedance (1907) sets the angle used by this function. Impedance determines the direction of current flow being measured and can be set from 0 to 90 degrees. The directional characteristic (line) in the complex impedance plane is shown in **Figure 5.2**. The directional characteristic is always perpendicular to the line impedance vector.

The sensing direction (1908) can be set to forward or reverse. The forward setting allows the directional protection element to pickup on fault current only in the direction opposite to normal power flow.

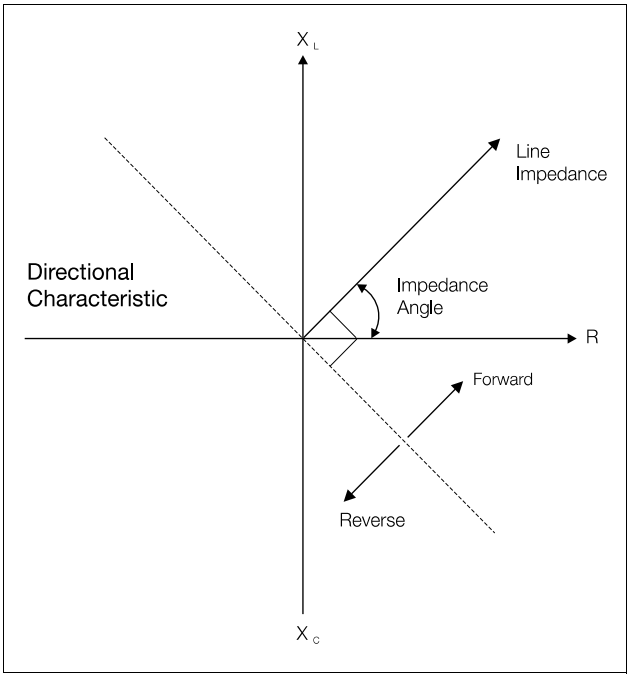


Figure 5.2 Directional Characteristic

Each of the two waveform capture buffers (1910 and 1911) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.10 Directional Neutral or Ground Time Overcurrent (67N)

The Directional Neutral or Ground Time Overcurrent function uses a selected time overcurrent characteristic curve to determine the trip time for the applied current at the fourth current input, utilizing the voltages present on the VTs to determine current direction. The defined characteristic curves are valid over a range of *multiple of pickup values*. The function also includes a customer defined curve. Refer to **Appendix A** for detailed trip curve information. This function is only available if the voltage input option is installed.

A2000	**Directional Neutral or Ground Time Overcurrent (67N)**	
Address	**Parameter**	**Option**
2001	Function	Enabled or Disabled
2002	Curve	Inverse Short Inverse Long Inverse Moderately Inverse Custom Very Inverse Extremely Inverse Definite Inverse Slightly Inverse I^2T Without Limit
2003	Pickup	5 A CTs: 0.5-20 A or 1 A CTs: 0.1-4 A (0.1 A steps)
2005	Time Dial	0.1-9.9 (0.1 steps)
2006	Filter	rms or fundamental
2007	Impedance	0-90°
2008	Direction	Forward or Reverse
2010	Freeze Wfm1	on Pickup, on Trip, or None
2011	Freeze Wfm2	on Pickup, on Trip, or None

The Directional Neutral or Ground Time Overcurrent function can be enabled or disabled (2001).

The Curve parameter (2002) allows the selection of the pre-programmed characteristic curve used by this function. The ISGS relay comes with nine standard overcurrent characteristic curves that can be adjusted with the time dial parameter (see below). The custom curve is a user-definable protective curve that integrates with instantaneous reset. The lower limit of the custom curve is 1.10. The maximum time to trip is the time at 1.10.

The range of the pickup value (2003) depends on the secondary phase neutral CT rating (1 A or 5 A) and the value is in secondary amperes. The function begins timing when any individual neutral current exceeds the pickup current setting.

Note: The pickup point is 1.06 of the pickup setting. Refer also to paragraph on **Pickup** in **Section 5.1**.

The Time Dial (2005) used for the selected curve allows the time-to-trip of the curve to be raised or lowered The dial can be adjusted from 0.1 to 9.9 in steps of 0.1.

The Filter (2006) sets the sensing method used by the function in its pickup calculations. The rms filter uses fundamental current plus harmonics, while the fundamental filter ignores harmonics.

Impedance (2007) sets the angle used by this function. It determines the direction of current flow being measured and can be set from 0 to 90 degrees. The directional characteristic (line) in the complex impedance plane is shown in **Figure 5.2**. The directional characteristic is always perpendicular to the line impedance vector.

The sensing direction (2008) can be set to forward or reverse. The forward setting allows the directional protection element to pickup on fault current only in the direction of normal power flow.

Each of the two waveform capture buffers (2010 and 2011) can be independently programmed to freeze snapshots on pickup or trip.

The Directional Neutral or Ground Time Overcurrent function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.11 Overvoltage (59)

The Overvoltage function causes a trip if the rms value of any of the line voltages exceeds a set level. This function is only available if the voltage input option is installed.

A2200	Overvoltage (59)	
Address	**Parameter**	**Option**
2201	Function	Enabled or Disabled
2202	Curve	Definite Inverse Moderately Inverse Very Inverse
2203	Pickup Source V	Line-to-ground Line-to-line
2204	Pickup	60-250 V (0.1 V steps)
2205	Time Delay (Def.)	0.1-60 s (0.01 s steps), or infinity
2205	Time Dial (Inverse)	0.1-9.9 (0.1 steps)
2210	Freeze Wfm2	on Pickup, on Trip, or None
2211	Freeze Wfm2	on Pickup, on Trip, or None

The Overvoltage function can be enabled or disabled (2201).

The Curve parameter (2202) allows the selection of a definite time delay or a characteristic curve. When the definite time characteristic is selected, the time delay begins as soon as the device goes into pickup. The inverse time characteristic utilizes a moderate inverse curve using the time dial.

The Pickup Source Voltage parameter (2203) indicates the VT connection. If the VTs are connected line-to-ground, the device can pickup on line-to-line or line-to-ground voltages. If the VTs are connected line-to-line, the VTs can only pickup on line-to-line voltages. The maximum continuous voltage across a VT input is 150 VAC.

The pickup value (2204) is in secondary volts ranging from 60 to 250 V. The function begins timing when any individual phase voltage exceeds the pickup voltage setting.

The time delay (2205) represents the time between pickup and trip and can be set when definite time is selected. The delay can be adjusted from 0.1 to 60.0 seconds in steps of 0.01 second. If the function remains in pickup for longer than the time delay, the function causes a trip. The delay can also be set to infinity so that the function never times out.

The Time Dial parameter (2206) is used for the characteristic curve. The dial allows the time-to-trip of the curve to be raised or lowered. It can be adjusted from 0.1 to 9.9 in steps of 0.1.

Each of the two waveform capture buffers (2210 and 2211) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.12 Undervoltage (27)

The Undervoltage function causes a trip if the rms value of any of the line voltages falls below a set level and can be useful for capturing power quality disturbances. This function is only available if the voltage input option is installed.

2300	Undervoltage 27	
Address	**Parameter**	**Option**
2301	Function	Enabled or Disabled
2302	Curve	Definite Inverse Moderately Inverse Very Inverse
2303	Pickup Source V	Line-to-Neutral or Line-to-Line
2304	Pickup	40-230 V (0.1 V steps)
2305	Time Delay (Def.)	0.1-60 s (0.01 s steps), or infinity
2305	Time Dial (Inverse)	0.1-9.9 (0.1 steps)
2310	Freeze Wfm 2	on Pickup, on Trip, or None
2311	Freeze Wfm 2	on Pickup, on Trip, or None

The Undervoltage function can be enabled or disabled (2301).

The Curve parameter (2302) allows the selection of a definite time delay or a characteristic curve. When the definite time characteristic is selected, the time delay begins as soon as the device goes into pickup. The inverse time characteristic utilizes a moderate inverse curve using the time dial.

The Pickup Source Voltage parameter (2303) indicates the VT connection. If the VTs are connected line-to-ground, the device can pickup on line-to-line or line-to-ground voltages. If the VTs are connected line-to-line, the VTs can only pickup on line-to-line voltages. The maximum continuous voltage across a VT input is 150 VAC.

The pickup value (2304) is in secondary volts ranging from 60 to 250 V. The function begins timing when any individual phase voltage exceeds the pickup voltage setting.

The time delay (2305) represents the time between pickup and trip and can be set when definite time is selected. The delay can be adjusted from 0.1 to 60.0 seconds in steps of 0.01 second. If the function remains in pickup for longer than the time delay, the function causes a trip. The delay can also be set to infinity so that the function never times out.

The Time Dial parameter (2306) is used for the characteristic curve. The dial allows the time-to-trip of the curve to be raised or lowered. It can be adjusted from 0.1 to 9.9 in steps of 0.1.

Each of the two waveform capture buffers (2310 and 2311) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.13 Phase Sequence Voltage (47)

The Phase Sequence Voltage function operates instantaneously if the correct system voltage phase sequence defined in the hardware configuration is not present at the device voltage inputs. This function will not respond if the input to the device is less than 40 V line-to-line or 23.1 V line-to-neutral. The function operates without delay or inverse time characteristic. It responds in 100 ms or less.

The Phase Sequence Voltage function can be used to prevent closure of a breaker. The assigned output contact would be wired to open a contact in the breaker-close circuit and remain activated until the line rotation is normal.

A2400	Phase Sequence Protection (47)	
Address	**Parameter**	**Option**
2401	Function	Enabled or Disabled
2410	Freeze Wfm 1	on Trip, or None
2411	Freeze Wfm 2	on Trip, or None

The 47 Phase Sequence Voltage function can be enabled or disabled (2401).

Each of the two waveform capture buffers (2410 and 2411) can be independently programmed to freeze snapshots on trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.14 Negative Sequence Voltage (47N)

The Negative Sequence Voltage function operates when the percent negative sequence voltage exceeds the preset value for a specified time. This function resets instantaneously when the negative sequence voltage drops below pickup.

A2400	Negative Sequence Voltage (47N)	
Address	**Parameter**	**Option**
2451	Function	Enabled or Disabled
2452	Curve	Definite or Inverse
2453	Pickup	4-40% negative sequence (1% steps)
2454	Time Delay (Def.)	0-100 s (0.01 s steps), or infinity
2455	Time Dial (Inverse)	0.1-9.9 (0.1 steps)
2456	Max Time (Inverse)	1-250 s (1 s steps)
2457	Blocked at	40-120 V (1 V steps)
2460	Freeze Wfm 2	on Pickup, on Trip, or None
2461	Freeze Wfm 2	on Pickup, on Trip, or None

The Negative Sequence Voltage function can be enabled or disabled (2451).

The Curve parameter (2452) allows the selection of a definite time delay or an inverse curve. The inverse time characteristic utilizes a moderate inverse curve using the time dial.

The pickup value (2453) ranges from 4% to 40% of negative sequence voltage. The function begins timing when the percent of negative sequence voltage exceeds the preset value for a specified time.

The time delay (2454) represents the time between pickup and trip and can be set when definite time is selected. The delay can be adjusted from 0 to 100 seconds in steps of 0.01 second. The delay can also be set to infinity so that the function never times out.

The Time Dial parameter (2455) is used for the characteristic curve. The dial allows the time-to-trip of the curve to be raised or lowered. It can be adjusted from 0.1 to 9.9 in steps of 0.1.

When the curve is set to inverse, the Max Time parameter (2456) sets an absolute maximum amount of time that the function will remain in pickup regardless of the inverse curve. The value ranges from 1 to 250 seconds and can be set in steps of 1 second.

Blocking (2457) can be set from 40 to 120 V. Regardless of the setting, the function is automatically blocked if the voltage drops below 40 V. An event will be generated when this function is blocked due to an undervoltage condition.

Each of the two waveform capture buffers (2460 and 2461) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.15 Overfrequency (81O)

The Overfrequency function has only a definite time characteristic and causes a time-delayed trip if the system line frequency rises above a set level.

A2500	Overfrequency (81O)	
Address	**Parameter**	**Option**
2501	Function	Enabled or Disabled
2502	Pickup	Nominal frequency 60.1-65.0 Hz (0.1 Hz steps)
2504	Time Delay	0-100 s (0.01 s steps), or infinity
2505	Blocked at	40-120 V (at VT input) (1 V steps)
2510	Freeze Wfm1	on Pickup, on Trip, or None
2511	Freeze Wfm2	on Pickup, on Trip, or None

The Overfrequency function can be enabled or disabled (2501).

The function begins timing when the frequency exceeds the pickup frequency setting (2503).

The time delay (2504) represents the time between pickup and trip. The delay can be adjusted from 0 to 100 seconds in steps of 0.1 second. The delay can also be set to infinity so that the function never times out.

Blocking (2506) can be set from 40 to 120 V. Regardless of the setting, the function is automatically blocked if the voltage drops below 40 V. An event will be generated when this function is blocked due to an undervoltage condition.

Each of the two waveform capture buffers (2510 and 2511) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.16 Underfrequency (81U)

The Underfrequency (81U) function has only a definite time characteristic and causes a time-delayed trip if the system line frequency drops below a set level. This function can be useful for load shedding applications.

A2500	81U Underfrequency	
Address	**Parameter**	**Option**
2551	Function	Enabled or Disabled
2553	Pickup	Nominal frequency 55.0-59.9 Hz (0.1 Hz steps)
2554	Time Delay	0-100 s (0.01 s steps), or infinity
2556	Blocked at	40-120 V (at VT input) (1 V steps)
2560	Freeze Wfm1	on Pickup, on Trip, or None
2561	Freeze Wfm2	on Pickup, on Trip, or None

The Underfrequency function can be enabled or disabled (2551).

The function begins timing when the frequency drops below the pickup frequency setting (2553).

The time delay (2554) represents the time between pickup and trip. The delay can be adjusted from 0 to 100 seconds in steps of 0.1 second. The delay can also be set to infinity so that the function never times out.

Blocking (2556) can be set from 40 to 120 V. Regardless of the setting, the function is automatically blocked if the voltage drops below 40 V. An event will be generated when this function is blocked due to an undervoltage condition.

Each of the two waveform capture buffers (2560 and 2561) can be independently programmed to freeze snapshots on pickup or trip.

The function is able to actuate any binary output contact on pickup, and any trip or binary output contact on trip.

5.17 Breaker Failure (50BF)

The Breaker Failure function responds to a fault condition where any phase current being measured by the CTs does not drop below a programmable level. Whenever another protective function activates the contact identified by the breaker parameter, (usually Trip 1), this function will wait until the set amount of time has expired. Then it checks the phase currents. If they are not equal to or less than the set pickup value, the function executes its defined actions.

2800	50BF Breaker Failure	
Address	**Parameter**	**Option**
2801	Function	Enabled or Disabled
2802	Pickup	5 A CTs: 0.25-5 A 1 A CTs: 0.05-1 A (0.01 A steps)
2804	Delay	8-254 cycles
2805	Check	current, breaker opened, current or breaker opened

The 50BF Breaker Failure function can be enabled and disabled (2801). When enabled, the protective function begins monitoring the current flow in the circuit following a trip command by the relay. Simultaneously, the protective function starts a timer. If the current flow does not drop below the pickup value specified (2802) and before the set time delay (2804) has elapsed, a breaker failure is assumed. At this point, another trip command can be issued to a different breaker (via a different output ocntact if available).

The condition of a breaker failure trip depend on the method chosen, the value of the current after the time has run out, and the position of the *a* and *b* switches.

The range of the pickup value (2802) is based on the secondary phase CT rating and is in secondary amperes.

The time delay (2804) represents the time between pickup and trip. The delay can be adjusted from 8 to 254 line cycles of delay. The function operates if it remains in pickup for longer than the time delay.

Breaker failure protection monitors the current flow only following a trip by the contact identified at address 1004 (see **Section 4.2**). This is the contact matrixed to the overcurrent protection.

Breaker position is sensed through dedicated binary inputs that monitor the 52a and 52b switches on the breaker mechanism (breaker mounted). The 52a and 52b switches have a total of four possible position combinations which can be decoded as illustrated in **Table 5.3**. The 52a and 52b switches referred to are those which traditionally provide indication of circuit breaker position (52b) and trip coil continuity (52a). All error reporting can be enabled and disabled, and the actions to be taken are configurable. Refer to **Section 6.6**.

Table 5.3 52a and 52b Switches Decoding

52a Switch Position	52b Switch Position	Condition Registered
Open	Open	Trip Coil Continuity Error, **or** Breaker Withdrawn
Open	Closed	Circuit Breaker Open
Closed	Open	Breaker Closed
Closed	Closed	Circuit Breaker Mechanism Error

Exceptions to the normal operating conditions include the presence of push-to-test switches across either the a-switch, b-switch, or both. A push-to-test switch across the b-switch will produce a false indication of a breaker mechanism error when the breaker is actually closed. A push-to test switch across the a-switch (and hence across the trip solenoid) will produce a false indication of a breaker mechanism error when the breaker is actually closed.

The Breaker Mechanism function (8305), when enabled, senses an error in the mechanism that controls the position of one or both switches (breaker mechanism error), causes an action to be taken, and an event to be logged if the switches are ever **both closed** for more than 100 ms. No other time delay is implemented. When this function detects an error, it is considered to be in pickup until the condition is no longer present.

The ISGS relay considers the b-switch to be more reliable. If it senses the switches **both open** at the same time, the breaker is considered to have a trip coil continuity error or to be withdrawn. The **52a** switch **closed** and the **52b** switch **open** are interpreted as a closed breaker. If the relay senses the **52a** switch **open** and the **52b** switch **closed**, the breaker is considered to be open. Refer also to **Table 5.3**.

5.18 Demand Setpoints

The ISGS relay is capable of activating outputs and sending events when predefined demand calculations exceed the set thresholds. These setpoints can be enabled or disabled and are capable of activating any output. Measurement and setpoint parameters in address block 3100 set the alarm reporting threshold for the ISGS relay.

The Demand Parameters function selects the time periods for demand calculations performed by the relay and allows the user to enable overcurrent demand and kilowatt demand protection.

3100	Demand Parameters	
Address	**Parameter**	**Option**
3101	Demand Interval	15, 30, 60 minutes
3102	Sync Time	0, 15, 30, or 45 after hour
3103	Subperiods 60	1, 2, 3, 4, 6, or 12
3104	Subperiods 30	1, 2, 3, or 6
3105	Subperiods 15	1 or 3
3106	I Av Dmd Function	Enabled or Disabled
3107	I Av Dmd Pickup	0-9999 A (1 A steps)
3108	KW Dmd Function	Enabled or Disabled
3109	KW Dmd Pickup	0-999,999 kW (1 kW steps)

Demand intervals (periods) are set to 15, 30, or 60 minutes (3101). Demand calculations are updated at the end of every demand period.

Demand period calculations can begin on the hour or at any quarter hour afterwards. The intervals are indicated as 0, 15, 30, or 45 minutes and are set in the Sync Time parameter (3102).

Demand calculations are made every subperiod (3103, 3104, or 3105). The number of subperiods depends on the length of the demand interval and is based on 10, the minimum number of monitoring intervals in a subperiod. For example, a 15 minute interval can have one or three subperiods, a 30 minute interval can have 1, 2, 3, or 6 subperiods. The length of a subperiod is your demand period divided by the number of subperiods.

The Average Current Demand function can be enabled or disabled (3106) in this Demand Setpoints function. When enabled, the Overcurrent Demand function causes an alarm if the average current demand value exceeds the setpoint.

The pickup value for the Average Current Demand function (3107) ranges from 0 to 9999 A.

The Kilowatt Demand function (3108) can be enabled or disabled. When enabled, the Kilowatt Demand function causes an alarm if the kilowatt demand value exceeds the setpoint.

The pickup value for the Kilowatt Demand function (3109) ranges from 0 to 999,999 kW.

5.19 Power Setpoints

The ISGS relay is capable of activating outputs and sending events when predefined power measurements exceed the set thresholds. These setpoints can be enabled or disabled and are capable of activating any output. Measurement and setpoint parameters in address block 3200 set the alarm reporting threshold for the ISGS relay.

The Power Setpoints function allows the setting of all power setpoints.

3200	**Power Setpoints**	
Address	**Parameter**	**Selection**
3201	KVAR Function	Enabled or Disabled
3202	KVAR Pickup	0-999,999 kVAR (1 kVAR steps) (default is 100000)
3203	KVAR Time Delay	0-3600 s (1 s steps) (default is 1800)
3204	KVA Function	Enabled or Disabled
3205	KVA Pickup	0-999,999 kVA (1 kVA steps)
3206	KVA Time Delay	0-3600 s (1 s steps) (default is 1800)
3207	PF Lead Function	Enabled or Disabled
3208	PF Lead Pickup	0.2-1.0 (0.1 steps) (default is 0.8)
3209	PF Lead Sign	lag or lead
3210	PF Lead Delay	0-3600 s (1 s steps) (default is 1800)
3211	PF Lag Function	Enabled or Disabled
3212	PF Lag Pickup	0.2-1.0 (0.1 steps) (default is 0.8)
3213	PF Lag Sign	lag or lead
3214	PF Lag Delay	0-3600 s (1 s steps) (default is 1800)

The kVAR and the kVA functions (3201 and 3203) can be enabled or disabled. If enabled, the functions cause an alarm if the kVAR or the kVA value exceeds the setpoint for the preset time delay.

The kVAR and the kVA function pickup value (3202 and 3204) ranges from 0 to 999,999 kVAR or kVA.

The time delay for kVAR and kVA can be adjusted from 0 to 3600 seconds in steps of 1 second.

The leading or lagging power factor function can be enabled or disabled (3207 and 3211). If one of the functions is enabled, it causes an alarm if the power factor value leads or lags the setpoint.

The threshold for both leading and lagging power factors (3208 and 3212) ranges from 0.2 to 1.0 in steps of 0.1.

The sign for the leading or lagging power factor (3209 and 3213) can be set to lead or lag.

The time delay for both leading and lagging power factors can be adjusted from 0 to 3600 seconds in steps of 1 second.

The leading setpoint will react if the measured power factor leads the setpoint for the set delay time. The lagging setpoint will react if the measured power factor lags the setpoint for the set delay time.

6 Control & Communications

6.1 Matrixing Events to Outputs

One of the powerful functions of the ISGS relay is its ability to send control outputs based on inputs from the real world. This process of assigning various outputs to various inputs is called matrixing. Utilities in Europe call this marshalling. Since most customers in America are not familiar with this term and because the word configuring is used in too many other contexts, we use the more specific word matrixing. The inputs that can be used to control outputs can be binary (on/off) inputs and communication events. The binary inputs determine if a certain type of protection is being violated and can close a trip contact or binary output based on the intelligence of the relay. The outputs can be trip contacts or binary outputs. **Figure 6.1** shows in general form how the outputs can be controlled by various inputs. The outputs can also be controlled by a command from an external communication device on the network; this input is called a Communication Event. The ISGS relay offers four binary inputs (BI 1, BI 2, BI 3, and BI 4), two binary outputs (BO 1, BO 2), and three trip contacts (Trip 1, Trip 2, and Trip 3). Matrixing is used for blocking and event-driven functions as well as for binary input and setpoint functions.

A physical input is a hardware connection to the relay such as binary input 1 (BI 1). A logical input is an input to a function internal to the relay such as the blocking input for undervoltage (protective function, 27) (see **Section 5.12**). The logical input can only be activated if it is matrixed to the physical input. Connecting the physical input BI 1 to the logical input for function number 27 allows BI 1 to block PF27 when active. Up to 10 logical inputs can be matrixed to each output contact.

A physical output is a trip contact or binary output (BO). A logical output is the output of a function internal to the relay such us Pickup, which is active when function 27 is in pickup. Connecting a logical output to a physical output allows function 27 to trip (actuate a contact). Up to 20 logical outputs can be matrixed to each output contact.

Note: Matrixing includes defining which protective functions actuate an output contact, and which output contact they actuate. Matching the output connections of the relay with the wiring connections of the protective circuit, including the connections to the circuit breaker, is extremely important. If the matrixing of the ISGS relay is changed, double-check the wiring of the protective circuit, and always test that the operation of a protective function results in the circuit breaker tripping.

Without matrixing, an event will cause an entry in the Event Log, but nothing will happen with the outputs and no control activity will occur. With matrixing, an event can cause the relay to trip a breaker (for example) as well as causing an entry in the Event Log.

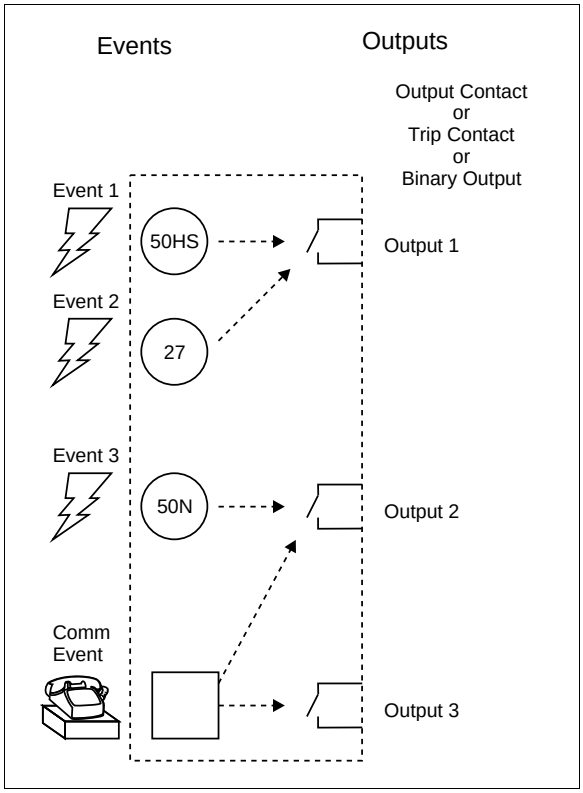


Figure 6.1 Matrixing Inputs to Outputs

Matrixing Procedure

The following steps provide a detailed description on how to matrix the ISGS relay manually using the front panel LCD and keypad. Before matrixing the relay, ensure that power is applied to the relay which is indicated by the lit system LED (green).

Table 6.1 Matrixing Procedure

How to Matrix Inputs to Outputs	
Step	**Description**
1	Press **Direct Addr** key; enter block address of one of the matrix functions (6100, 6200, or 6400) using the numeric keypad; press **Enter** key. OR Press **Direct Addr** key; enter the address of the desired parameter using the numeric keypad; press **Enter** key. Skip to step 4. A complete list of ISGS relay parameters is provided in **Appendix C**.
2	Use **Single Arrow** keys to scroll to the desired address.
3	Press **F** key once; use **Single Arrow** keys to scroll to the desired matrix position (001-020)
4	Press **Password** key; enter your level 3 password followed by **Enter** key. The message "PW THREE ACCEPTED" appears. Press **Enter** key again to return to the screen displayed last before password entry. For password levels, proper password entry, and display messages, refer to **Section 3.3**.
5	The display cursor located next to the address is blinking (otherwise repeat step 4). Press **No** key until the desired parameter option appears on display. Press **Enter** key to set the displayed option. Your settings can be undone any time while still in the same address block by simply returning to the parameter and assigning a new value. Use **Single Arrow** keys to move to the next matrix position to change additional parameters, or proceed to the next step.
6	Press **F** key. At the blinking cursor position, the letter F is displayed. Press **Enter** key. Message "SAVE NEW SETTINGS?" appears.
7	Press **Yes** key followed by **Enter** key to save settings and reset relay to new parameters. Message "NEW SETTINGS SAVED" appears. Press **No** key to abort any changes made. Message "SAVING PROCEDURE ABORTED" appears.
8	Press **Enter** key to return to screen displayed last before starting saving procedure.

⚠ WARNING

Unprotected system during reconfiguration.

If fault occurs during reconfiguration, can result in death, severe personal injury, or equipment damage.

Do not change device configuration or matrixing while the relay is in service.

Before changing device configuration, open the associated switching device and remove from service.

When the configuration or matrixing is changed, the relay may require up to 60 seconds to re-initialize and does not provide protection for the power system during the re-initialization time period.

Wisdom Software

While the ISGS relay can be matrixed manually using the keypad and LCD, Wisdom configuring and analysis software allows faster and easier configuration by connecting a PC installed to either data port. For data port connections refer to **Section 2.5.1**. All binary inputs, binary outputs, and the trip contacts can be simply checked off inside the configuration window of protective and other functions. Refer to **Chapter 8** for more description of how this can be done with Wisdom software.

6.2 Binary Inputs

Binary inputs are optically-isolated voltage level sensors with a fixed threshold. The input is considered activated if voltage above the threshold is applied and de-activated if no voltage or voltage below the threshold is applied.

The status of the binary inputs is monitored whether they are configured or not. As a result, the relay logs events when any binary input changes state (from active to de-active or vice versa).

Actions matrixed to binary inputs have the choice of being performed when the binary input is activated (Hi) or de-activated (Lo). For example, **BI1 >blk 50 Hi** means that 50 is blocked when BI1 is activated. And **BI1 >blk 50 Lo** means that 50 is blocked when BI1 is de-activated.

The ISGS relay displays the options at each matrix position in the sequence listed in the table below.

6100	**Binary Inputs**			
Address	**Para-meter**	**Matrix Position**	**Option**	**Option (cont.)**
6101	Input 1	001 to 010 (Options apply to each matrix position)	not matrixed Frz.Buff1 Hi Frz.Buff1 Lo Frz.Buff2 Hi Frz.Buff2 Lo blk 47N Hi blk 47N Lo blk 47 Hi blk 47 Lo blk 81U Hi blk 81U Lo blk 81O Hi blk 81O Lo blk 50 Hi blk 50 Lo blk 50N Hi blk 50N Lo blk 50HS Hi blk 50HS Lo blk 50HSN Hi blk 50HSN Lo blk 51N Hi blk 51N Lo	blk 59 Hi blk 59 Lo blk 27 Hi blk 27 Lo blk 67 Hi blk 67 Lo blk 67N Hi blk 67N Lo blk 50BF Hi blk 50BF Lo blk ComEvt Hi blkComEvt Lo SwitchPara Hi SwitchPara Lo BI1 Hi BI1 Lo BI2 Hi BI2 Lo BI3 Hi BI3 Lo BI4 Hi BI4 Lo
6102	Input 2	001-010	(same as Input 1 above)	
6103	Input 3	001-010	(same as Input 1 above)	
6104	Input 4	001-010	(same as Input 1 above)	

On power-on or reset, the relay creates an internal state change of all binary inputs to determine whether they are active or inactive, and it performs all actions corresponding to their condition and matrixing accordingly.

Binary inputs can be matrixed to disable the acceptance of communication events.

6.3 Binary Outputs

The ISGS relay offers two binary outputs. The options at each matrix position are displayed in the sequence listed in the table below.

6200	**Binary Outputs**			
Address	**Para-meter**	**Matrix Position**	**Option**	**Option (cont.)**
6201	Output 1 (BO 1)	001 to 020 (Options apply to each matrix position)	not matrixed BI1 BI2 BI3 BI4 Error Sum I Error Sym I Error Sym V OC Pickup OC Trip Non OC PU Non OC Trip Relay Pickup Relay Tripped no f f <> 50HS Trip 50HSN Trip 81O Pickup 81O Trip UV blks 81O 81U Pickup 81U Trip UV blks 81U 47N Pickup 47N Trip UV blks 47N 50HS blks 50 50HSN blks 50 50 Pickup 50 Trip 50HS blks 50N 50HSN blks 50N 50N Pickup 50N Trip 50HS blks 51 50HSN blks 51	51 Pickup 51 Trip 50HS blks 51N 50HSN blks 51N 51N Pickup 51N Trip 67 Pickup 67 Trip 67N Pickup 67N Trip 27 Pickup 27 Trip 59 Pickup 59 Trip 47 Trip OvrBrOps PU OvrBrAmps PU OvrAmpsDmd PU OvrkWDmd PU OvrkVAR PU OvrkVA Pickup PFLag Pickup PFLead Pickup 50BF Pickup 50BF Trip TrScMon PU TrCoilCont PU BrMech PU CommEvent 1 CommEvent 2 CommEvent 3 CommEvent 4 CommEvent 5
6202	Output 2 (BO 2)	001-020	(same as Output 1 above)	

6.4 Trip Contacts

The ISGS relay offers up to three trip contacts which are monitored by the microprocessor. Trip contacts may be configured by the user to trip the relay based on any of a number of functions. Trip contact reaction time is about 4.5 ms.

The relay displays the options at each matrix position in the sequence listed in the table below.

6400	Trip Contacts			
Address	**Parameter**	**Matrix Position**	**Option**	**Option (cont.)**
6401	Contact 1	001 to 020 (Options apply to each matrix position)	not matrixed BI1 BI2 BI3 BI4 OC Trip NonOC Trip Relay Tripped 50HS Trip 50HSN Trip 81O Trip 81U Trip 47N Trip 50 Trip 50N Trip 51 Trip 51N Trip 67 Trip 67N Trip 27 Trip	59 Trip 47 Trip OvrBrOps PU OBrAmps PU OvrAmps-Dmd PU OkWDmd PU OvrkVAR PU OvrkVA PU PFLag PU PFLead PU 50BF Trip TrScMon PU TrCoilCont PU BrMech PU CommEvent 1 CommEvent 2 CommEvent 3 CommEvent 4 CommEvent 5
6402	Contact 2	001-020	(same as Contact 1 above)	
6403	Contact 3	001-020	(same as Contact 1 above)	

6.5 Comm Events

Protective functions are internally generated events that can trip a relay. For the protection to function properly, the processor interprets these events (inputs) and makes a decision. Communication (Comm) events are externally generated messages that can trip a relay without any interpretation. This remote communication allows Comm events to control outputs (contacts), such as opening a breaker; or switch parameter sets if matrixed to a binary input. Comm events are sent from a PC or other devices on the RS-232 or RS-485 networks.

Comm events can be blocked (disabled) with binary inputs to prevent remote parameterization during service periods or as a general safety measure. Refer to the list of binary inputs in **Section 6.2**.

6.6 Breaker Monitoring

To increase the security of the protective system, it is helpful to monitor several parameters directly from the switchgear. The ISGS relay can monitor the components such as the 52a and the 52b switches, the traditional circuit breaker position lamps, and the tripping voltage supply.

The 52a and 52b switches have a total of four possible position combinations which can be decoded as illustrated in **Table 6.1**. The 52a and 52b switches referred to are those which traditionally provide indication of circuit breaker position (52b) and trip coil continuity (52a). All error reporting can be enabled and disabled, and the actions to be taken are configurable.

Table 6.1 52a and 52b Switches Decoding

52a Switch Position	52b Switch Position	Condition Registered
Open	Open	Trip Coil Continuity Error, **or** Breaker Withdrawn
Open	Closed	Circuit Breaker Open
Closed	Open	Breaker Closed
Closed	Closed	Circuit Breaker Mechanism Error

The ISGS relay monitors:

- breaker position
- trip coil continuity
- trip source impedance.

Breaker position is sensed through dedicated binary inputs that monitor the 52a and 52b switches on the breaker mechanism (breaker mounted). Trip coil continuity is monitored by continually sensing a current that flows through the trip coil. Trip source impedance is checked using a switchable electronic load across the trip voltage supply.

8300	Breaker Monitoring	
Address	**Function/ Parameter**	**Options**
8301	TripSrcImp	Enabled or Disabled
8302	TripSrcFail	Yes or No
8303	TrpCoil Cont	Enabled or Disabled
8304	TrpCoilFail	Yes or No
8305	BrkrMech	Enabled or Disabled

Exceptions to the normal operating conditions include the presence of push-to-test switches across either the a-switch, b-switch, or both. A push-to-test switch across the b-switch will produce a false indication of a breaker mechanism error when the breaker is actually closed. A push-to test switch across the a-switch (and hence across the trip solenoid) will produce a false indication of a breaker mechanism error when the breaker is actually closed.

The Trip Source Impedance parameter (8301) can be enabled or disabled. When enabled, the circuit periodically monitors the trip supply voltage (auxiliary voltage, station battery) and will perform an action (for example, close a binary output) should the voltage drop below ANSI minimum values. Monitoring the trip source (auxiliary power) to detect bad connections and weak batteries is done by periodically drawing a small current from the trip supply and monitoring the subsequent sag in the voltage. Using averaging techniques, the trip source impedance can be estimated. Based on this estimate, an error message is given if the source voltage drops below ANSI minimum values during a trip event. When the function is enabled, it can cause the actuation of any of the output contacts. This circuit can function only in true DC trip systems. It should be disabled and the inputs left disconnected when the device is used in AC trip systems.

The Trip Source Fail parameter of the Trip Source Impedance function (8302), when set to yes, allows the relay fail contact to be asserted when the monitoring function detects an error. When set to no, the relay fail contact is not affected.

The Trip Coil Continuity function (8303), when enabled, senses a trip coil continuity error, causes an action to be taken, and logs the event if the 52a and 52b switches are ever **both open** at the same time for more than 100 ms. No other time delay is implemented. When the function detects the error, the function is considered to be in pickup until the condition is no longer present.

The Trip Coil Fail parameter of the Trip Coil Continuity function (8304), when set to yes, allows the relay fail contact to be asserted when the monitoring function detects an error. When set to no, the relay fail contact is not affected.

Because the 52b switch does not need to interrupt the current through the trip coil, it provides a reliable indication of breaker position: when it is open, the breaker is considered closed. The practice (in DC trip systems) of placing a red status indicator lamp in series with the trip coil allows a convenient method for monitoring the continuity of the trip coil. When the circuit breaker is closed, the 52a switch is closed and the voltage across them and the trip coil is small because most of the voltage drop occurs across the indicating lamp circuit. If the trip coil is open or the a-switch is defective, an error condition exists and an alarm can be generated. An exception is a breaker withdrawn for servicing.

The Breaker Mechanism function (8305), when enabled, senses an error in the mechanism that controls the position of one or both switches (breaker mechanism error), causes an action to be taken, and an event to be logged if the switches are ever **both closed** for more than 100 ms. No other time delay is implemented. When this function detects an error, it is considered to be in pickup until the condition is no longer present.

The ISGS relay considers the b-switch to be more reliable. If it senses the switches **both open** at the same time, the breaker is considered to have a trip coil continuity error or to be withdrawn. The **52a** switch **closed** and the **52b** switch **open** are interpreted as a closed breaker. If the relay senses the **52a** switch **open** and the **52b** switch **closed**, the breaker is considered to be open. Refer also to **Table 6.1**.

6.7 Logs and Breaker Monitor Reset

With the Reset function, the user can independently reset logs and breaker monitoring functions. Performing the reset operation for an individual category will reset all values within that category to zero, but new values are tracked immediately. The Resets address block also includes functions to set the number of breaker operations and the sum of interrupted current on each phase.

8200	**Resets**	
Address	**Function**	**Option/Display**
8201	Trip Log	yes, in progress, successful
8202	Min/Max Values	yes, successful
8203	Energy	yes, successful
8204	Breaker Ops	yes, successful
8205	Sum I interrupted	yes, in progress, successful
8211	Breaker Ops (Counter)	0-65535
8212	Sum IL1	0-99999 kA (0.01 kA steps)
8213	Sum IL2	0-99999 kA (0.01 kA steps)
8214	Sum IL3	0-99999 kA (0.01 kA steps)

The Trip Log reset function (8201) can be set to yes to reset the values in all trip logs. This function requires a password. When the parameter is activated by setting it to yes, the LCD displays the message “IN PROGRESS” followed by the message “SUCCESSFUL”.

Resetting the minimum and maximum logs with the Min/Max Values reset function (8202) discards all current values, but new minimum and maximum values are tracked immediately.

The Energy reset function (8203) resets all demand values.

The Breaker Operations reset function (8204) resets the breaker operations counter.

The sum of interrupted current reset function resets the sum of interrupted current for each phase (8205).

The Breaker Operations (Counter) reset function (8211) sets the number of breaker operations, for example, when moving the breaker to a cubicle protected by an ISGS relay where the previous breaker had a different operations count.

The Sum of Interrupted Current for phases A, B, and C reset functions (8212, 8213, 8214) can be set from 0 to 99999 kA.

6.8 Breaker Operations Count

Breaker Operations refers to the number of times the device has opened the breaker. The Breaker Operation function allows the setting of the breaker monitoring parameters.

The *Sum of Interrupted Current* is the total sum of the currents that were interrupted by these breaker openings. The setpoint is triggered when any phase exceeds the set limit.

3500	Breaker Operation	
Address	**Parameter**	**Selection**
3501	Int. I Function	Enabled or Disabled
3502	Int. I Pickup	0-9999.90 kA (0.01 kA steps)
3503	Brks Ops Function	Disabled or Enabled
3504	Brks Ops Counter	0-65535

The Interrupted I (current) Function (3501) can be enabled or disabled. When enabled, the function generates an event (which can be matrixed to an output contact) when the interrupted current exceeds the pickup value. The interrupted current pickup value (3502) can be set to any value from 0 to 9999.90 kA in steps of 0.01 kA.

The Breaker Operations Function (3503) can be enabled or disabled. When enabled, the function counts the breaker operations since the last reset.

The Breaker Operations Counter (3504) can be set from 0 to 65535.

6.9 Hardware Status (Relay Data)

The Relay Data function provides additional hardware information on the ISGS relay, shows all set binary inputs and outputs, and displays a relay identification string.

7400	Relay Data	
Address	**Data**	**Description**
7401	Circuit Name	String of up to 16 characters
7402	MainBd S/N	Serial number of main board
7403	MainBd ID	ID number of main board
7404	OptBd1 S/N	Serial number of option board 1
7405	OptBd1 ID	ID number of option board 1
7406	OptBd2 S/N	Serial number of option board 2
7407	OptBd2 ID	ID number of option board 2
7408	Bin. Inputs	Binary input status
7409	Bin. Outputs	Output contact status

The Circuit Name (7401) identifies a relay, breaker, bus, or feeder which your ISGS relay is protecting. This string (up to 16 characters) is user-definable with Wisdom software. Accessing this parameter through the keypad allows only the display of this string.

All circuit boards installed in your ISGS relay are provided with a serial number and a special identification number. These numbers can be displayed by accessing addresses 7403 to 7407.

Similar to the firmware version identification number of your ISGS relay described in **Section 4.1**, the serial and identification numbers of your main board and optional board(s) help Siemens track the versions and options available on your boards.

Binary Inputs (7408) displays the status of the binary inputs as illustrated in **Figure 6.2**. The status updates automatically as they change.

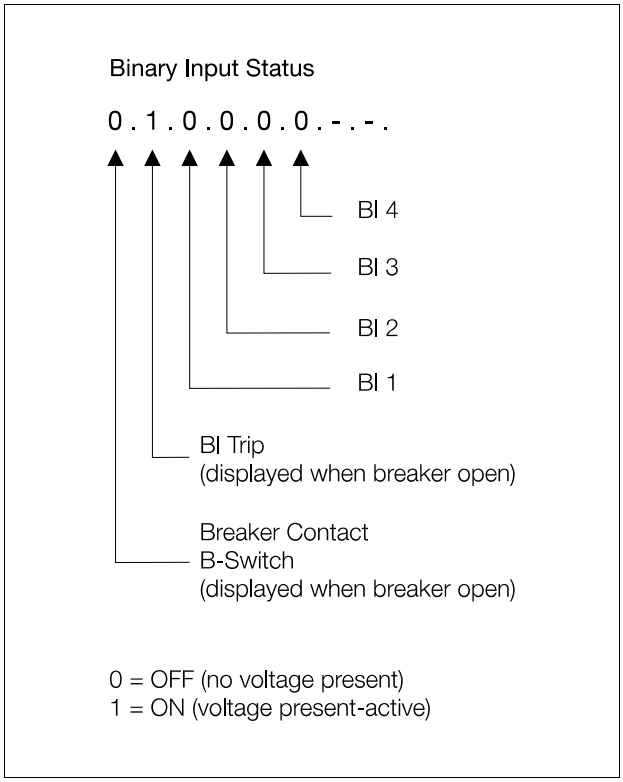


Figure 6.2 Binary Input Status

Binary Outputs (7409) displays the output contact status as illustrated in **Figure 6.3**. The status updates automatically as they change.

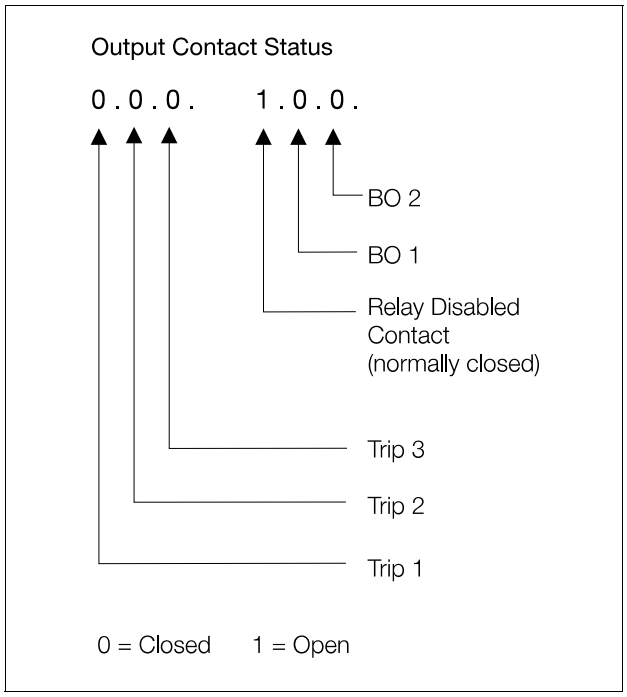


Figure 6.3 Output Contact Status

6.10 Self-Monitoring (Value Supervision)

Value supervision refers to the relay's ability to monitor its own input and measurement functions for problems. The complete chain, from input transformers up to and including the A/D converter internal to the ISGS, is monitored by a plausibility check on the measured values. These checks consist of voltage balance checks, current balance checks, and current summation checks.

Voltage or current balance checks can be performed to detect open or short circuits in the external transformers and their connections. Current summation checks are performed on the instantaneous samples of the A/D converter.

A useful application of the current and voltage balance and monitoring functions is the detection of blown VT fuses. A blown fuse condition can be said to exist when the following conditions are present:

Voltage is present but unbalanced,

AND

current is present but NOT unbalanced.

$$\left(V_1 > 25\ V\right) AND \left(V_2 < 0.33\ V_1\right)$$

$$AND \left(I_2 < 0.167\ I_1\right) OR \left(I_1 < 0.1\ I_N\right)$$

where V_1 = positive sequence voltage
I_2 = negative sequence current
I_1 = positive sequence current
I_N = nominal current (1 or 5 A)

Therefore, a voltage balance alarm in the absence of a current unbalance alarm is a good indication that a fuse is blown. If a current unbalance alarm were also active, it would indicate the presence of negative sequence current and therefore a fault rather than a blown VT fuse.

3400	**Value Supervision**	
Address	**Parameter**	**Selection**
3401	Function V Bal	Enabled or Disabled
3402	Pickup V Bal	40-120 V (0.1 V steps) (default is 100)
3404	Factor V Bal	0.58-0.95 (0.01 steps) (default is 0.8)
3411	Function I Sum	Enabled or Disabled
3412	Pickup I Sum	5 A CTs: 0.5-5 A 1 A CTs: 0.1-1 A (0.1 A steps)
3414	Factor I Sum	0.10-0.95 (0.01 steps) (default is 0.1)
3421	Function I Bal	Enabled or Disabled
3422	Pickup I Bal	5 A CTs: 0.5-5 A 1 A CTs: 0.1-1 A (0.1 A steps)
3424	Factor I Bal	0.10-0.95 (0.01 steps) (default is 0.8)

Voltage Balance

The Voltage Balance function can be enabled or disabled (3401). When enabled, the function monitors the phase voltages to see if they are approximately balanced (of equal magnitude). Balance is defined as the ratio of minimum to maximum voltage, where the maximum voltage is the largest and the minimum voltage the smallest of the three voltages determined by the way the relay is connected (line-to-line or line-to-neutral).

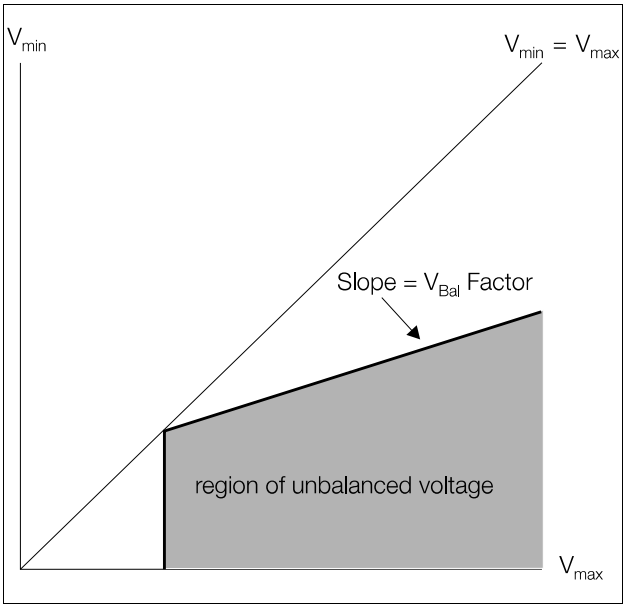


Figure 6.4 Voltage Balance Threshold

Monitoring is done when the maximum voltage is larger than the voltage balance pickup value. The voltage is considered balanced and will not cause an alarm if the voltage min/max ratio is larger than the voltage balance factor. The voltage is unbalanced and will cause an alarm if the min/max ratio is smaller than the voltage balance factor.

Failure of this check will cause an event *Voltage Balance Error.* This event can activate an output contact.

The voltage balance pickup value (3402) can be set from 40 to 120 V in steps of 1 V. If one of the three phase voltages is above the preset threshold, the function checks for balance.

The voltage balance factor indicates the amount of unbalance tolerated before the function generates an alarm (3404). It ranges from 0.58 to 0.95 and can be set in steps of 0.01.

Current Summation

The Current Summation function can be enabled or disabled (3411). When enabled, it monitors the instantaneous samples of the A/D converter using the currents flowing into all four relay CTs regardless of whether there are four primary CTs connected or not. The calculation is therefore valid for systems with both residual connections or explicit neutral/ground/zero sequence CTs.

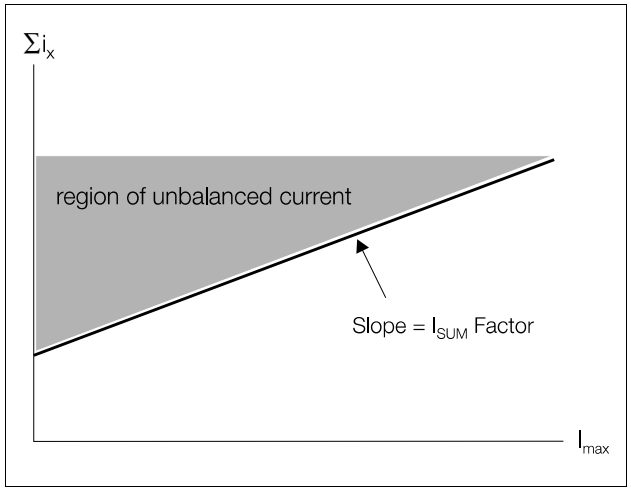


Figure 6.5 Current Sum Threshold

Failure of this check will cause an event *Current Summation Error.* This event can activate an output contact.

The pickup value (3412) for the current summation check depends on the secondary phase CT rating and the value is in secondary amperes. The value for 5 A CTs ranges from 0.5 A to 5.0 A; and the value for 1 A CTs ranges from 0.1 to 1.0 A. Both values can be set in steps of 0.1 A. If one of the three phase currents is above the preset threshold, the monitoring function is activated.

The current summation factor indicates allowable compensation for differences between primary CTs (3414). It ranges from 0.1 to 0.95 and can be set in steps of 0.01. This factor is important under high fault currents or when CTs are operated closely to their rated current.

Current Balance

The Current Balance function can be enabled or disabled (3421). When enabled, the function monitors the phase currents to see if they are approximately balanced (of equal magnitude). Balance is defined as the ratio of minimum to maximum current, where the maximum current is the largest and the minimum current the smallest of the three phase currents.

Current balance monitoring is done when the maximum current is larger than the current balance pickup value. The current is considered balanced and will not cause an alarm if the current min/max ratio is larger than the current balance factor. The current is unbalanced and will cause an alarm if the min/max ratio is smaller than the current balance factor.

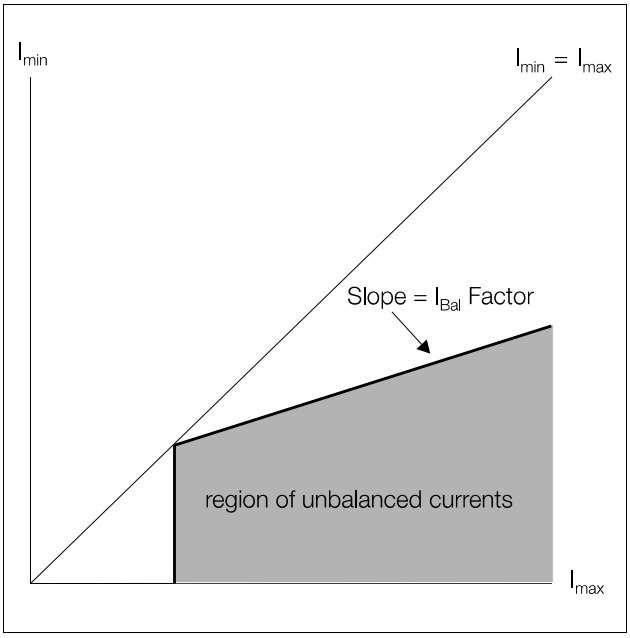


Figure 6.6 Current Balance Threshold

Failure of this check will cause an event *Current Balance Error.* This event can activate an output contact.

The pickup value (3422) for the current balance check depends on the secondary phase CT rating and the value is in secondary amperes. For 5 A CTs, the value ranges from 0.5 to 5.0 A; and the value for 1 A CTs ranges from 0.1 to 1.0 A. Both values can be set in steps of 0.1 A. If one of the three phase currents is above the preset threshold, the monitoring function is activated.

The current balance factor indicates the amount of unbalance tolerated before the function generates an alarm (3424). This factor is provided to compensate for differences between primary CTs. It ranges from 0.1 to 0.95 and can be set in steps of 0.01.

6.11 Parameter Sets

The ISGS relay can be programmed to operate with **either** of two parameter sets—set A or set B. Separate parameter sets are programmed to satisfy separate user defined conditions, such as seasonal considerations or special operating periods. For example, set A may be used for protective settings used in the summertime, whereas set B might comprise the settings appropriate to winter, when lower ambient temperatures could allow higher loading than in the summer. Alternatively, set A might be configured for normal production periods, with set B reserved for construction or periodic shutdown periods. The choice of two separate parameter sets prevents the need to reconfigure the relay when conditions change and different parameter settings are desired.

Figure 6.2 shows the use of these parameter sets. The values in set A or B may be chosen as the active set, and are thus put in the relay's memory for easy access. The default set includes all the factory default values and these values are stored in long-term memory.

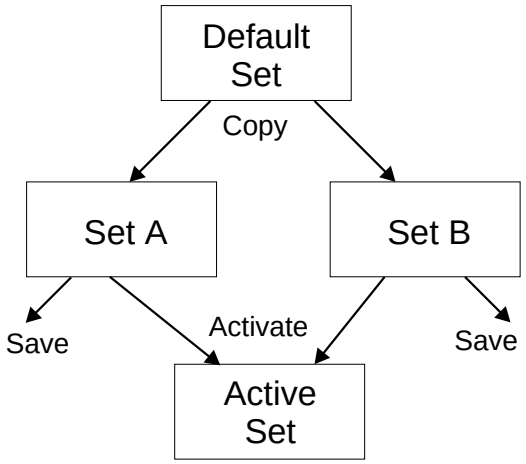


Figure 6.2 Parameter Set Actions

7101	**Parameter Set**	
Address	**Parameter**	**Description**
7101	Active Set	Displays active parameter set (A or B)
7103	Activation	Activate set A or set B
7104	Copy Default to A	Copy default set to set A
7105	Copy Default to B	Copy default set to set B
7106	Copy A to B	Copy set A to set B
7107	Copy B to A	Copy set B to set A

Only certain protective function parameters have two settings. All A settings are grouped under parameter set A, and all B settings are grouped under parameter set B. Each parameter set automatically includes all the regular parameters that can be programmed to only one setting at a time

and, therefore, apply to both sets. Examples are protective function enable settings and matrixed output contacts such as waveform buffers and blocking. All parameter set functions require a password.

6.11.1 Active Set

The active parameter set refers to the parameter set that is currently used by the ISGS relay—set A or set B. The Active Set parameter (7101) indicates which set is currently active on the LCD using the letter A or B.

Refer to **Section 6.11.3** on how to make a parameter set the active set.

6.11.2 Default Set

The default set refers to factory default parameter settings. These are stored in read-only memory (ROM) and cannot be overwritten. The default set cannot become an active set in itself, it has to be copied to either set A or set B (7104 and 7105).

6.11.3 Switching Sets

A parameter set can be made active by selecting the desired set in the Activation parameter (7103). Switching between sets requires 4.5 seconds.

Note: Switching the parameter sets could cause a trip if the pickups are set lower than in the previous set. View the settings before activating the new set.

Switching between parameter sets for viewing and configuring parameter settings is possible regardless of address or address level currently displayed by the LCD, or whether the parameter can be configured to an alternate setting.

```
A1502 Pickup 50
110 A
```

1. At any address, press the **F** key

```
A1502FPickup 50
110 A
```

   followed by either **1** (set A) or **2** (set B).

   The LCD displays the following message:

```
PARAMETER SET
COPIED TO EDIT
```

2. Press **Enter**. The parameter set has switched to the alternate set. The LCD displays the same address and function as before the switch, but the address prefix has changed to the letter representing the displayed parameter set. The alternate parameter may or may not contain a value depending on whether the alternate parameter had been configured before.

```
B1502 Pickup 50
```

   If the parameter was not configurable to an alternate set (had no prefix), the display will not have changed.

   Note: Switching the parameter sets for viewing and configuration does not make the alternate set active.

For detailed descriptions on how to display, configure, save, and switch parameters, and when to use a password, refer to the standard operating procedures in **Section 3.5**.

Exceptions to the switching of sets are binary inputs, binary outputs, and the trip contacts in the 6000 address blocks. For these parameter settings, the relay retains these values regardless of the parameter set. For example, if the output contact is set while set A is active, switching to set B will not change the output contact setting.

6.11.4 Copying Sets

Parameter settings for set A can be copied to set B and vice versa (7106 and 7107). Factory default settings can also be copied to either set A or set B (7104 and 7105), but no parameter set can override the default settings.

6.12 Communications Port

The Configure Communications Port function lets the user change the communications parameters for the ISGS relay.

7200	Configure Communications Port	
Address	**Parameter**	**Options**
7201	Local Port (front)	2400, 4800, 9600, 19,200 baud
7202	System Port (rear)	2400, 4800, 9600, 19,200 baud
7203	Parameter Change	Enabled or Disabled
7204	Comm Events	Enabled or Disabled
7207	Local Address	1-254

The ISGS relay can connect at 2400, 4800, 9600, and 19,200 baud at both ports (7201 and 7202). Higher baud rates will improve response and update rate, but slower PCs may lose characters due to the high rate. Both ports can be operated at different baud rates and simultaneously.

The Parameter Change function can be enabled or disabled. When enabled, this function allows the remote change of the parameter sets (A or B).

The Comm Events function can be enabled or disabled (7204). When enabled, this function allows remote activation of the breaker and binary outputs. The function can be disabled to prevent remote access during service periods or as a general security measure. For more information on Comm Events, refer to **Section 6.5**.

The Local Address parameter (7207) can be changed by entering a value from 1 to 254 to assign the local SEAbus address. Make sure that the new address does not represent a duplicate address of another device connected to the communications loop.

6.13 Passwords

The Configure Passwords function allows the change or display of the three passwords. This function requires your old password before you can access the individual parameters. All passwords can consist of one to five digits.

7300	Configure Passwords	
Address	**Parameter**	**Range**
7301	CW-Level 1	1 to 5 digits
7302	CW-Level 2	1 to 5 digits
7303	CW-Level 3	1 to 5 digits

Only the level 3 password (7303) can set all passwords. Use this level if you intend to change all passwords. Level 1 and level 2 passwords (7301 and 7302) can be displayed and changed by entering the respective level password.

A lower level password does not allow you to scroll to a higher level password parameter. But the higher level password always lets you move to the lower level(s). For example, entering the level 2 password allows you to view and change the passwords for level 2 and level 1, but the same password does not provide access to view or change the level 3 password.

6.14 Date and Time Setting

The Date and Time Setting function sets the date and time of the ISGS relay to match it with other connected devices and to provide an accurate setting for event and trip information.

8100	Date and Time Setting	
Address	**Data**	**Range**
8101	Current Date	01/01/1970 00:00:00
8102	Set Date	mm.dd.yyyy
8103	Set Time	hh.mm.ss

The Current Date parameter (8101) displays the present date and time on the clock in the ISGS relay. The date and time is used to stamp the event and trip logs.

The date can be changed with the Set Date parameter (8102). To enter the date, separate the month, day, and year with a decimal point. Each field must contain two digits with the exception of the year field which must contain four digits (mm.dd.yyyy).

The time can be changed with the Set Time parameter (8103). To enter the time, separate hours, minutes, and seconds with a decimal point. Each field must contain two digits (hh.mm.ss).

Note: The clock in an ISGS relay is not a real-time clock. It has no battery backup and will drift over time.

If the relay is connected to an ACCESS system, the supervisory software used for this system, for example, WinPM, reads all relays and synchronizes their clocks. If the relay is not connected to an ACCESS system, date and time should be set periodically, at least once a day, for accurate event and trip information. Date and time must always be reset after a loss of control power.

When reading events, the time can be off as much as 10 ms because events (inputs) are not interrupt driven; they are polled about every 10 ms. Binary inputs are also slower than protective functions; events can be reported later even if they occurred earlier.

Notes:

7 Data Acquisition

The ISGS relay provides several forms of data acquisition and display to give the user the most comprehensive picture of the power system. This data includes:

- event log for monitoring functions and status changes
- trip logs, including date and time of trip
- minimum/maximum logs for storing metering data
- individual metering data
- waveform captures

7.1 Event Log

The event log is a chronological record of the last 127 significant events that occur during operation of the relay and is stored in nonvolatile memory. These events include operational events, such as enabling or disabling protective elements; and fault events, such as pickup and trip. Each entry in the log provides a description of the event and its time (to nearest millisecond) and date of occurrence.

The event log cannot be viewed through the ISGS relay operator panel. It can only be viewed after being retrieved through one of the relay communication ports using either Wisdom or WinPM software.

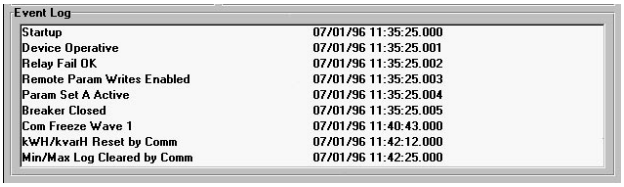


Figure 7.1 Sample Event Log (viewed with Wisdom)

Events that require special attention appear in the event log in red when displayed on a PC. The entire event log can be saved to a file (for later viewing or printing) using Wisdom software. For information on Wisdom software, refer to **Chapter 8**.

Whenever the ISGS relay resets, such as when changing parameter sets or output control actions, the event log is considered invalid and all events are re-read by communications.

7.2 Trip Logs

The Trip Logs function stores times and measured data present at the time of pickup and trip for the last eight trip events. The information for each trip is stored in its own log. These eight logs are located at address blocks 5100 through 5800. The most recent trip event is stored under address 5100 and the oldest of the eight trip events is stored in address 5800. Pressing the **Trip Log** key takes you directly to the trip log address block. The first trip to be sensed is the trip to be logged

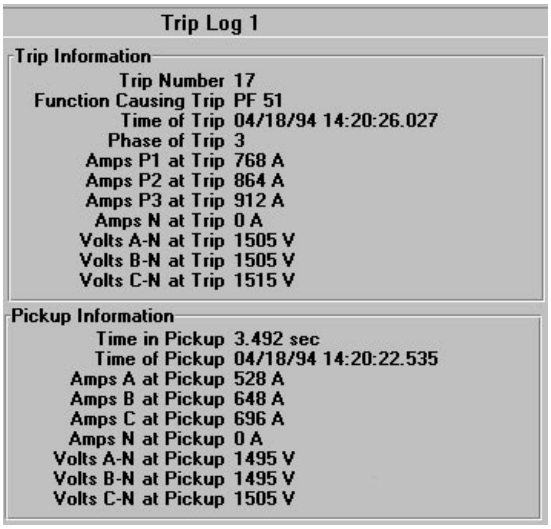


Figure 7.2 Sample Trip Log Data Display (from Wisdom)

5100 to 5800	**Trip Logs**	
Address	**Data**	**Description**
001	Trip Number	Date and event record number
002	Pickup Time	Time of the event to the nearest millisecond
003	Pickup	The function that picked up
004	Phase	The phase that picked up
005	I1	Current at pickup for phase 1
006	I2	Current at pickup for phase 2
007	I3	Current at pickup for phase 3
008	IN	Ground current at pickup
009	V1	Voltage at pickup phase 1 (1-2*)
010	V2	Voltage at pickup phase 2 (2-3*)
011	V3	Voltage at pickup phase 3 (3-1*)
012	Trip	The function that caused the trip
013	Phase	The phase that caused the trip
014	I1	Secondary current at trip for phase 1
015	I2	Secondary current at trip for phase 2
016	I3	Secondary current at trip for phase 3
017	IN	Secondary Ground current at trip
018	V1	Secondary voltage at trip phase 1 (1-2*)
019	V2	Secondary voltage at trip phase 2 (2-3*)
020	V3	Secondary voltage at trip phase 3 (3-1*)
021	TinPU	Total time in pickup
022	End of Table	Last entry in this log

* If VTs are connected line-to-line (see address 1202, **Section 4.5**), the line-to-line voltage is displayed.

For each log the following applies:

- The ISGS relay keeps a lifetime count of protective function trips. The trip number (address 001) is the count at the time of the trip. The trip number cannot be reset unless the relay is returned to the factory.
- The pickup time (002) consists of the date and time of the event to the nearest millisecond.
- The pickup parameter (003) refers to the protective function that caused the trip. Only protective function trips are stored in the log (no breaker monitoring, setpoints, or communications trips are logged).
- The phase parameter (004) stores the current or voltage phase(s) that violated protective function settings.
- I1, I2, I3, and IN parameters (005 to 008) give the currents at pickup for phases A, B, C, and the ground current.
- V1, V2, and V3 (009 to 011) indicate the voltage at pickup for phases A, B, and C. If VTs are connected line-to-line (refer to address 1202, **Section 4.5**, the line-to-line voltage is displayed for phases A-B, B-C, and C-A.
- Trip (012) displays the function that caused the trip.
- Phase (013) indicates the phase that caused the trip.
- I1, I2, I3, and IN (014 to 017) give the secondary currents at trip for phases A, B, C, and the ground current.
- V1, V2, and V3 (018 to 020) indicate the voltage at pickup for phases A, B, and C. If VTs are connected line-to-line (refer to address 1202, **Section 4.5**, the line-to-line voltage is displayed for phases A-B, B-C, and C-A.
- Total time in pickup (021) is the total time that the relay read the voltage above the pickup value, not the time the breaker is told to open or actually opens. The timer is only reset when no function is in pickup.

Events that require special attention appear in the event log in red when displayed on a PC. For information on Wisdom software, refer to **Chapter 8**.

7.3 Min/Max Logs

7.3.1 Current Minimum/Maximum Log

The Current Minimum/Maximum Log function allows the display of minimum and maximum values measured by the relay. The collected information is compared against previously stored values and the log is updated. All logged values are time stamped and resetting the log (see **Section 6.7**) will reset all log values.

4600	**Current Minimum/Maximum Log**	
Address	**Data**	**Description**
4601	I1 min	Phase A minimum current
4602	I1 max	Phase A maximum current
4603	I2 min	Phase B minimum current
4604	I2 max	Phase B maximum current
4605	I3 min	Phase C minimum current
4606	I3 max	Phase C maximum current
4607	IN min	Ground minimum current
4608	IN max	Ground maximum current
4609	IAv min	Average minimum current
4610	IAv max	Average maximum current
4611	I1 dmin	Phase A minimum demand current
4612	I1 dmax	Phase A maximum demand current
4613	I2 dmin	Phase B minimum demand current
4614	I2 dmax	Phase B maximum demand current
4615	I3 dmin	Phase C minimum demand current
4616	I3 max	Phase C maximum demand current
4617	IAv dmin	Average minimum demand current calculated
4618	IAv dmax	Average maximum demand current calculated
4619	MinTHD	Minimum value of estimated total harmonic distortion
4620	MaxTHD	Maximum value of estimated total harmonic distortion

The MinTHD and MaxTHD parameters (4619 and 4620) display the minimum or maximum total harmonic distortion calculation for the average current. The calculation is an estimate of the harmonics on the system rather than an exact measurement.

7.3.2 Voltage Minimum/Maximum Log

The Voltage Minimum/Maximum Log function allows the display of minimum and maximum values measured by the relay. The collected information is compared against previously stored values and the log is updated. All logged values are time stamped and resetting the log (see **Section 6.7**) will reset all log values. No voltages are metered unless the VT option is installed.

4700	Voltage Minimum/Maximum Log	
Address	**Data**	**Description**
4701	V12 min	Minimum phase voltage between phases A and B
4702	V12 max	Maximum phase voltage between phases A and B
4703	V23 min	Minimum phase voltage between phases B and C
4704	V23 max	Maximum phase voltage between phases B and C
4705	V31 min	Minimum phase voltage between phases C and A
4706	V31 max	Maximum phase voltage between phases C and A
4713	VAv min	Minimum average voltage
4714	VAv max	Maximum average voltage
4717	MinTHD	Minimum value of estimated total harmonic distortion
4718	MaxTHD	Maximum value of estimated total harmonic distortion

The MinTHD and MaxTHD parameters (4717 and 4718) display the minimum or maximum total harmonic distortion calculation for the average current. The calculation is an estimate of the harmonics on the system rather than an exact measurement.

7.3.3 Power Minimum/Maximum Log

The Power Minimum/Maximum Log function allows the display of minimum and maximum values measured by the relay. The collected information is compared against previously stored values and the log is updated. All logged values are time stamped, and resetting the log (see **Section 6.6**) will reset all log values. No voltages are metered unless the VT option is installed.

4800	Power Minimum/Maximum Log	
Address	**Data**	**Description**
4801	kW min	Minimum power value
4802	kW max	Maximum power value
4803	kW dem min	Minimum active power demand value
4804	kW dem max	Maximum active power demand value
4805	kVA min	Minimum kilovolt-ampere value
4806	kVA max	Maximum kilovolt-ampere value
4807	kVAR min	Minimum kilovolt-ampere reactive value
4808	kVAR max	Maximum kilovolt-ampere reactive value
4809	PF max	Maximum power factor value
4810	PF min	Minimum power factor value

7.3.4 Frequency Minimum/Maximum Log

The Frequency Minimum/Maximum Log function allows the display of minimum and maximum values measured by the relay. The collected information is compared against previously stored values and the log is updated. All logged values are time stamped, and resetting the log (see **Section 6.7**) will reset all log values.

4900	Frequency Metering	
Address	**Data**	**Description**
4901	Fmin	Minimum frequency value
4902	Fmax	Maximum frequency value

7.4 Metered Data

Metered data is stored by the ISGS relay and can be displayed by accessing address blocks 4100 to 4900. The display of this data does not require a password. You can display the same data more conveniently by using Wisdom software described in **Chapter 8**.

7.4.1 Current Values

The Current Metering function stores the metered current and current demand values for the ISGS relay. The relay will measure and display the rms values of the current for the three phases and ground or neutral. The ISGS relay also shows total harmonic distortion as a percentage of the fundamental for the three phase current inputs. This function displays *undefined* when the measured components are below the total harmonic distortion threshold.

4100	Current Metering	
Address	**Data**	**Range[1]**
4101	I Phase A	0-250% I_{CT}
4102	I Phase B	0-250% I_{CT}
4103	I Phase C	0-250% I_{CT}
4104	I Neutral	0-250% I_{CT}
4105	I Average	0-250% I_{CT}
4106	I Demand Phase A	0-250% I_{CT}
4107	I Demand Phase B	0-250% I_{CT}
4108	I Demand Phase C	0-250% I_{CT}
4109	I Demand Average	0-250% I_{CT}
4110	THD Current	0-250% I_{CT}
[1] I_{CT} = primary CT rating		

7.4.2 Voltage Values

The Voltage Metering function allows the display of metered voltage data for the ISGS relay. The rms voltage measurements for this function depend on the selected VT connection method, either line-to-ground or line-to-line. The relay also shows total harmonic distortion as a percentage of the fundamental for the three phase voltage inputs. It displays *undefined* when the measured components are below the total harmonic distortion threshold. This function is only available if the voltage input option is installed.

4200	Voltage Metering	
Address	**Data**	**Range[1]**
4201	V Phases A-B	10-125% V_n
4202	V Phases B-C	10-125% V_n
4203	V Phases C-A	10-125% V_n
4204	V L-L Average	10-125% V_n
4209	THD Volts	10-125% V_n
[1] I_{VT} = primary VT rating		

7.4.3 Power Values

The Power Metering function stores the metered voltage data for the ISGS relay. This function is only available if the voltage input option is installed.

4300	Power Metering	
Address	**Data**	**Range**
4301	kW 3-Phase	0-999,999.99 kW
4302	kW Hours	0-999,999.99 kWHR
4303	kW Demand	0-999,999.99 kWD
4304	kVA 3-Phase	0-999,999.99 kVA
4305	kVAR 3-Phase	0-999,999.99 kVAR
4306	kVAR Hours	0-999,999.99 kVARH
4307	PF	-1 — 0 — +1

7.4.4 Frequency Values

The Frequency Metering function allows the display of the system frequency. This function is only available if the voltage input option is installed.

4400	Frequency Metering	
Address	**Data**	**Range**
4401	Frequency	45-65 Hz

7.5 Meter Display

The Operating Parameters function allows the user to determine what appears in Line 1 and Line 2 of the Power On Meter display described in **Chapter 4**.

7000	Operating Parameters	
Address	**Parameter**	**Options**
7005	LCD Line 1	I avg, Idmd1, Idmd2, Idmd3, Idmdavg, V1-2, V2-3, V3-1, VLLavg, V1-N, V2-N, V3-N, VLNavg, W, WH, Wdmd, VA, VAR, VARH, PF, f, I1, I2, I3, IN
7006	LCD Line 2	I avg, Idmd1, Idmd2, Idmd3, Idmdavg, V1-2, V2-3, V3-1, VLLavg, V1-N, V2-N, V3-N, VLNavg, W, WH, Wdmd, VA, VAR, VARH, PF, f, I1, I2, I3, IN

The operating parameters can be set to provide you with a quick and constantly updated overview of your most important data.

7.6 Waveform Capture

The Waveform Capture function sets the pre-trigger time of the two waveform buffers. You can configure the ISGS relay to capture waveforms on a variety of events. For example, waveforms can be captured for protective functions on pickup or trip, or for communication events.

8400	Configure Waveform Capture	
Address	**Parameter**	**Range**
8401	Wfm1Pretrp	100-900 ms, default is 800 ms, (1 ms steps)
8402	Wfm2Pretrp	100-900 ms, default is 800 ms, (1 ms steps)

Each buffer stores one full second of data for each wave. This second always includes the event that caused the trip. The pre-trip parameter of each buffer (8401 and 8402) lets you specify where in the buffer the event appears. By setting a time in milliseconds, you indicate how much data of this one second wave data you want included in the buffer prior to the trip.

For example, if buffer 1 is configured to be captured on trip (see also **Chapter 5** and its protective functions with waveform capture), and the activity that led up to the trip is of great interest, buffer 1 can be configured to contain 900 ms of pre-trigger data. These first 900 ms of pre-trigger data represent the signal before the actual trip. The remaining 100 ms show the signal after the trip.

A waveform stored in a buffer will be lost after a loss of control power. Exporting an important waveform immediately to a file will prevent unexpected data loss.

Notes:

8 ISGS Wisdom Software

8.1 Overview

The ISGS relay is an extremely advanced protective relay for medium voltage switchgear applications. In order to reduce the complexity of configuring the relay, reading the metered values, and retrieving stored data, Siemens developed ISGS Wisdom software. Wisdom software is a Windows-based tool that monitors and controls an ISGS relay. Wisdom software provides a flexible, easy to use interface allowing the performance of a wide variety of tasks such as

- remote configuration via network, local port, or modem
- offline configuration in DEMO mode
- configuration file storage
- custom curve creation
- display and retrieval of captured waveforms
- event log retrieval
- real-time data and status display

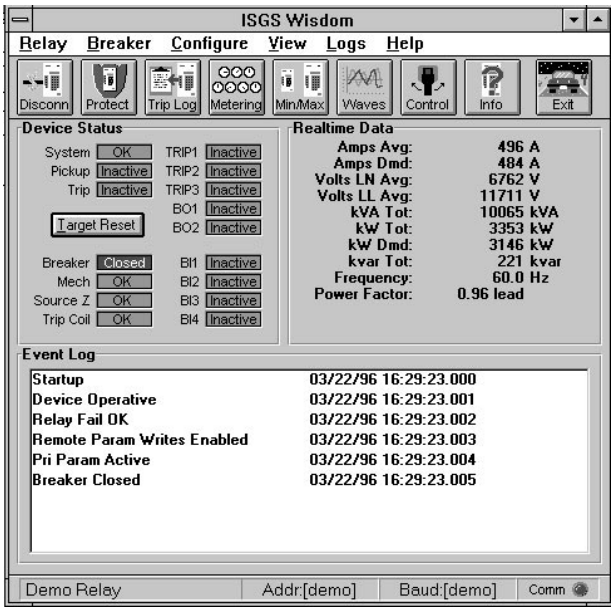


Figure 8.1 Wisdom Main Window

Note: For a free copy of Wisdom software, fax a request to **919-365-2552**. Please include your name, company, phone number, fax number, mailing address, and e-mail address (if applicable). The software can also be downloaded from the World Wide Web at **http://www.sea.siemens.com**. Search for *Wisdom Software* using the Search function.

8.2 Setup

Using Wisdom software requires Microsoft® Windows®. To make full use of the Waveform Capture display, a color monitor is highly recommended. Setting up Wisdom software requires two basic operations:

1. Installing the program on a PC

   Wisdom software is provided on a floppy diskette. The setup program on this diskette will install Wisdom software on your hard drive and will create a Windows program group icon.

2. Connecting the relay to the PC

   For local connection of the PC, install an RS-232 interface cable between the serial communications port on the PC and the front port on the relay.

   For remote connection of the PC, use an RS-232 to RS-485 converter for direct connection and null-modem connectors for modem use.

Wisdom software offers five main menus from which to select the various tasks or operations to be performed and one help menu.

8.3 Menus

In the main window, you can choose from the following main menus: Relay, Breaker, Configure, View, Logs, and Help. The Main Window also displays the Event Log which is automatically updated (refer to **Figure 8.1**). The Event Log can be saved or re-read. These commands can be found in the Logs menu.

Relay Menu

From the Relay menu, you can connect or disconnect the ISGS relay, save or load device data, select parameter sets, and synchronize the internal time of your device with the time of your computer.

Breaker Menu

From the Breaker menu, you can control breakers and reset targets.

The Control submenu opens or closes the breaker and asserts or releases the communication events. Refer to **Figure 8.2**.

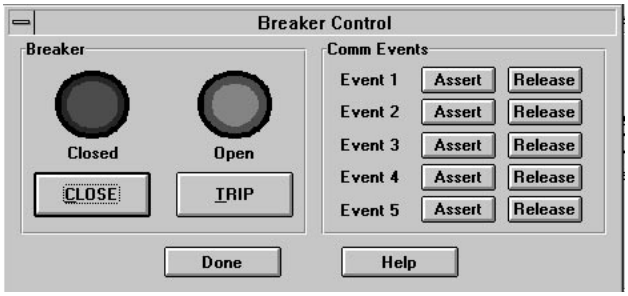


Figure 8.2 Breaker Control

Configure Menu
The Configure menu provides an easy way to set the parameters for the following areas:

- Communications
- Protection Functions
- Breaker Monitoring
- ISGS Hardware
- Demand
- Alarms
- Value Supervision
- I/O Setup
- Passwords

Each function or task offers an individual window with an overview of the complete set of parameters available and their default or user-defined settings. A simple click with the mouse selects your choices from check boxes, option buttons, or list boxes. A slider lets you adjust ranges in predefined steps within minimum and maximum values. Refer to **Figure 8.3**.

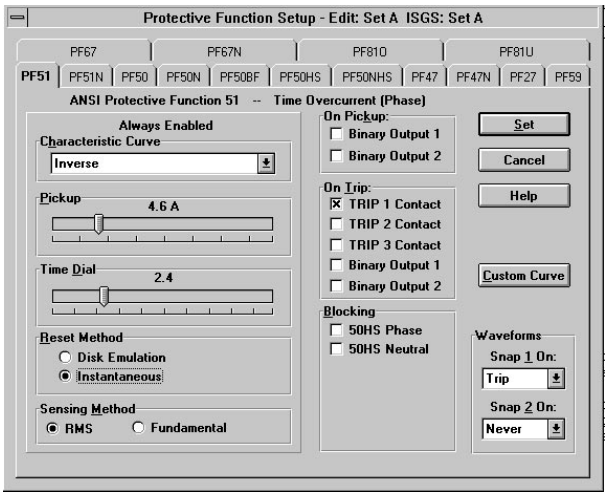


Figure 8.3 Configuring a Protection Function

View Menu
The View menu offers functions for processing and displaying various forms of data stored in the relay.

The Info submenu displays device data such as CT and VT ratings.

The Realtime Data submenu allows a complete data display at one glance (refer to **Figure 8.4**).

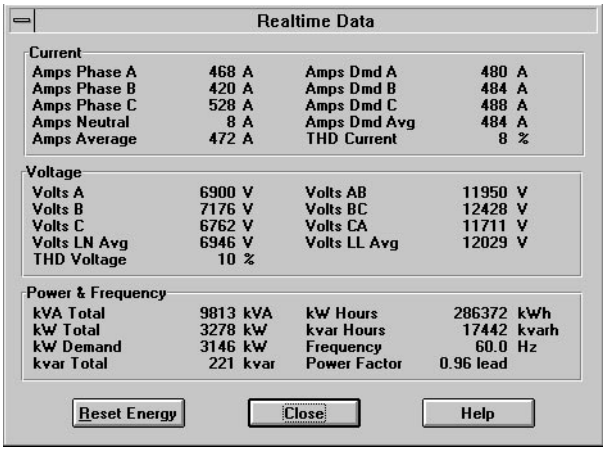


Figure 8.4 Real-Time Data Display

The Waveform Capture submenu opens a color display that allows you to freeze and then retrieve all waveform data, selectively or together from either of the two buffers. The curves are color coded for easy identification. From the same window, you can configure your waveform settings, view your trip logs and display a buffer summary. Refer to **Figure 8.5**.

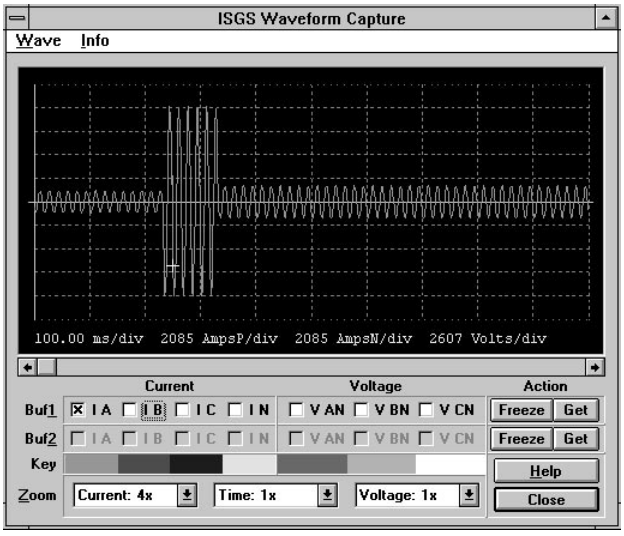


Figure 8.5 Waveform Capture

The Marshalling display provides an overview of all trip and binary input settings. Refer to **Figure 8.6**.

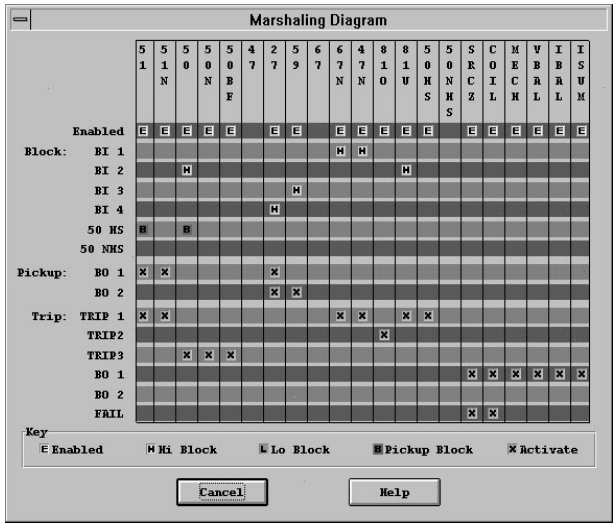


Figure 8.6 Marshalling Display

Logs Menu

The Logs menu allows a complete data display of the Trip Logs and the Min/Max Log at one glance (see **Figure 8.7** and **Figure 8.8**. This menu also contains the commands for saving or re-reading the Event Log.

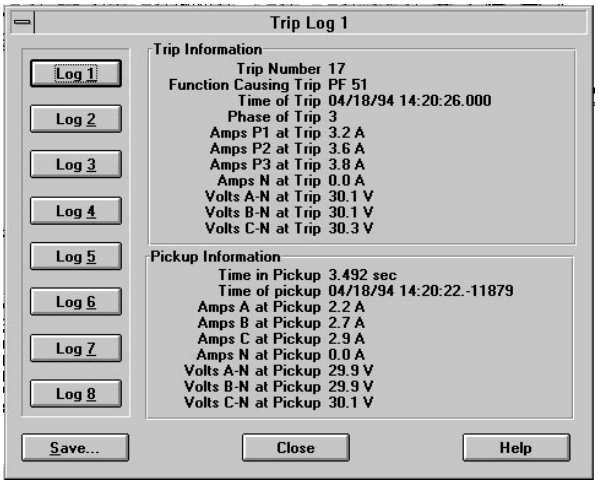


Figure 8.7 Trip Log Data Display

Figure 8.8 Min/Max Log Data Display

Help Menu

The Help menu provides detailed information on how to use Wisdom software. The menu allows searching for and printing of specific help topics. The Help menu contains an ISGS relay settings worksheets that can be printed and used for manual configuration of the device if desired.

8.4 Demo Mode

To evaluate the software offline, a demonstration mode is provided that allows all of the program functions to be exercised without actual connection to an ISGS relay. Information on the methods and equipment required to connect the personal computer to the relay are included in the Help function.

In addition to allowing experimentation, the demo mode permits the user to create relay configuration files that can be saved and used at a later time to configure an actual relay.

Notes:

A Trip Curves & Equations

This section provides equations and curve characteristics for current and voltage to show the relationship between trip time and threshold levels. Determine which curve closely follows the requirements of your system and select this curve in the applicable protective functions.

A.1 Instantaneous Curve

The Instantaneous response characteristics can be used with protection functions 50, 50N, 50HS, and 50HSN.

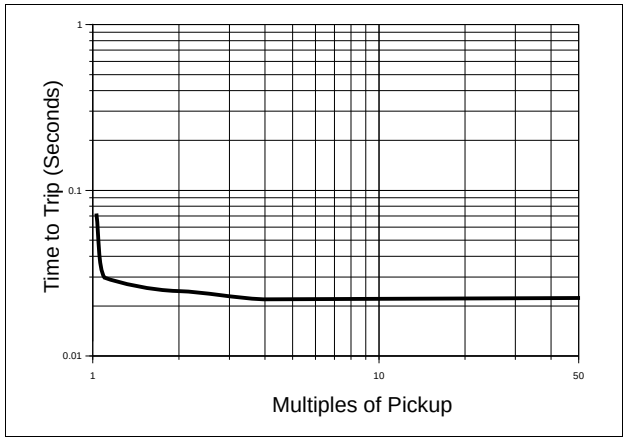


Figure A.1 Instantaneous Curve

A.2 Standard Time Overcurrent Equation

The ISGS comes with nine standard overcurrent characteristic curves that can be adjusted with a time dial parameter. Seven of the nine curves are based on suggested IEEE standards for approximation of electromechanical relays.
Table A.1 describes the first seven curves (SEA1 to SEA7) listed below.

Standard Overcurrent Coefficients					
Curve Type	**Des.**	**A[1]**	**B[1]**	**N[1]**	**t_r**
Inverse	SEA 1	8.9341	0.17966	2.0938	8.8
Short Inverse	SEA 2	0.2663	0.03393	1.2969	0.831
Long Inverse	SEA 3	5.6143	2.18592	1.0000	12.9
Moderately Inverse	SEA 4	0.3022	0.12840	0.5000	1.07
Very Inverse	SEA 5	5.4678	0.10814	2.0469	5.741
Extremely Inverse	SEA 6	7.7624	0.02758	2.0938	7.432
Slightly Inverse	SEA 7	0.4797	0.21359	1.5625	1.5625
[1] The A, B, and N coefficients are for the standard relay formula					

Table A.1 Standard Overcurrent Coefficients

Trip Characteristic

$$For\ \frac{i}{ip} > 1: \qquad T = \frac{AD}{\left(\frac{i}{ip}\right)^N - 1} + BD + 0.028$$

Reset Characteristic

$$For\ \frac{i}{ip} < 1: \qquad T = \left| \frac{t_r D}{\left(\frac{i}{ip}\right)^N - 1} \right|$$

T = time to trip, in seconds

$\left(\frac{i}{ip}\right)$ = multiple of pickup setting

D = time dial setting, 0.1 to 9.9 in steps of 0.1

A, B, N, t_r = constants

Equation A.1 Standard Inverse Curves Equation

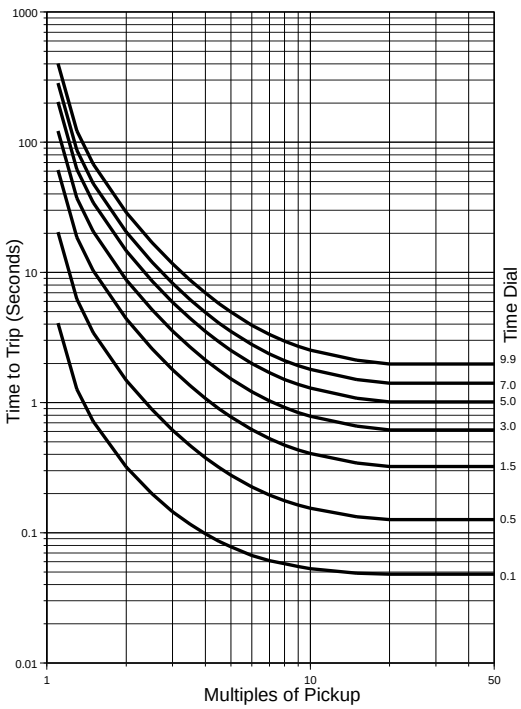


Figure A.2 Inverse Curve (SEA1)

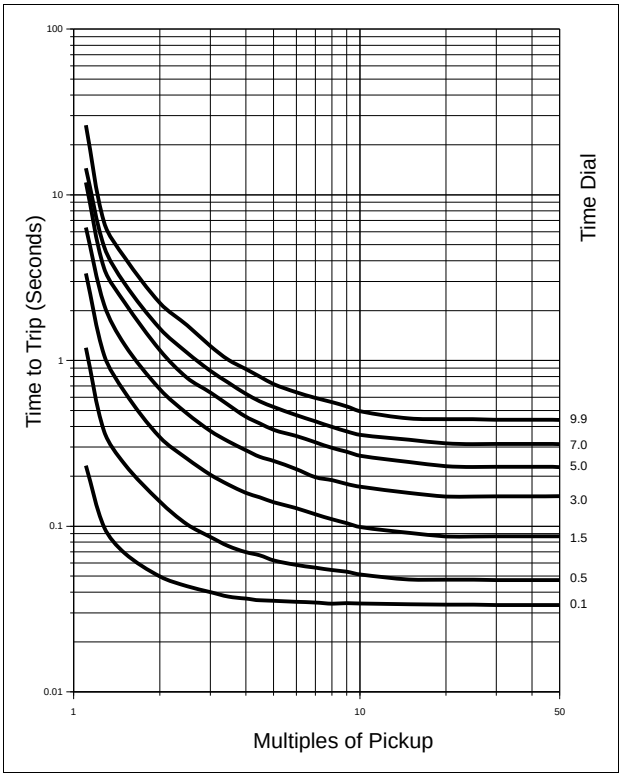


Figure A.3 Short Inverse Curve (SEA2)

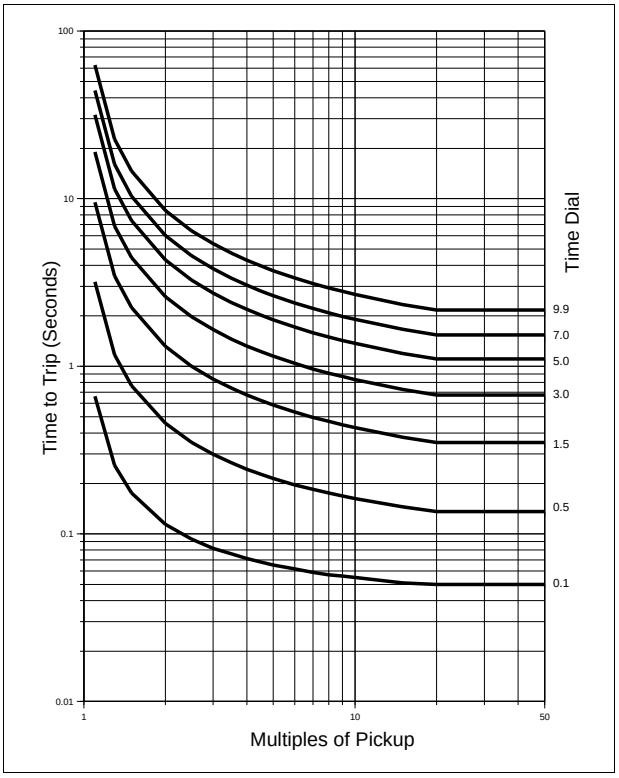


Figure A.5 Moderately Inverse Curve (SEA4)

A

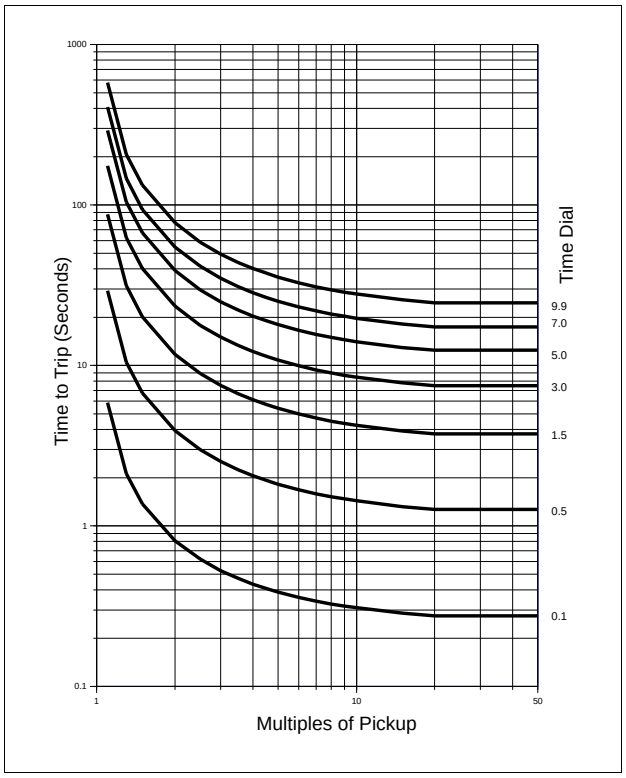


Figure A.4 Long Inverse Curve (SEA3)

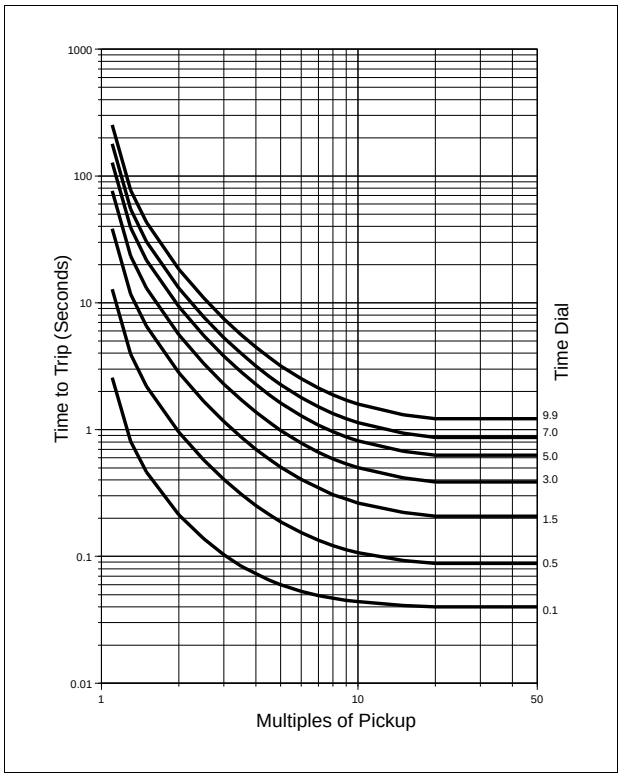


Figure A.6 Very Inverse Curve (SEA5)

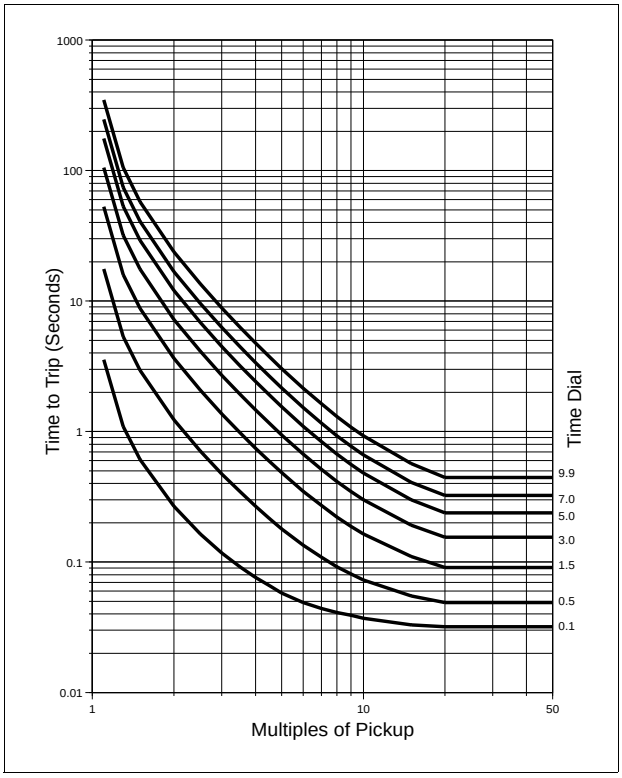


Figure A.7 Extremely Inverse Curve (SEA6)

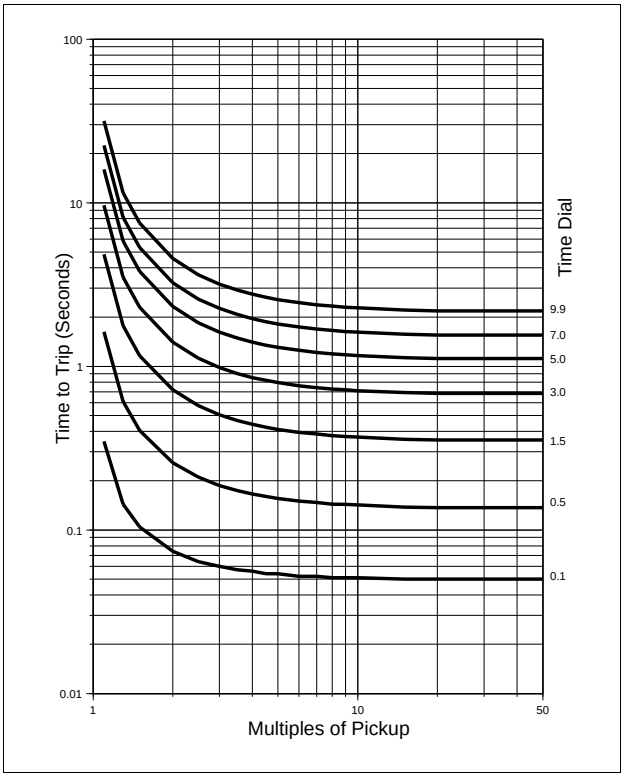


Figure A.8 Slightly Inverse Curve (SEA7)

A.3 Definite Inverse Equation

Equation A.2 The ISGS provides an emulation of the popular CO-6 Definite Inverse characteristic. This curve is defined by the equations shown in **Equation A.3**.

Trip Characteristic

$$For\ \frac{i}{ip} > 1.5$$

$$T = \left[785 + \frac{671}{\left(\frac{i}{ip}\right)^{N} - 1.19}\right] \times \frac{6.33D + 0.37}{24000}$$

$$For 1.0 < \frac{i}{ip} < 1.5:$$

$$T = \left[785 + \frac{671}{\left(\frac{i}{ip}\right)^{N} - 1.19}\right] \times \frac{6.33D + 0.37}{24000}$$

Reset Characteristic

$$For\ \frac{i}{ip} < 1: \qquad T = \left|\frac{t_r D}{\left(\frac{i}{ip}\right)^{N} - 1}\right|$$

T = time to trip, in seconds

$\left(\frac{i}{ip}\right)$ = multiple of pickup setting

D = time dial setting, 0.1 to 9.9 in steps of 0.1

t_r = reset constant = 1.0394

N = inverse constant = 2.54096

Equation A.3 Definite Inverse Equation

In **Equation A.3**, the time dial term 6.33D + 0.37 is necessary to convert the time dial range defined by Westinghouse and the range that Siemens is using.

Equation (1) is valid for values of I/Ip greater than 1.5 and equation (2) is valid for values of I/Ip between 1.0 and 1.5 (note that the equation is undefined at I/Ip = 1.0).

A

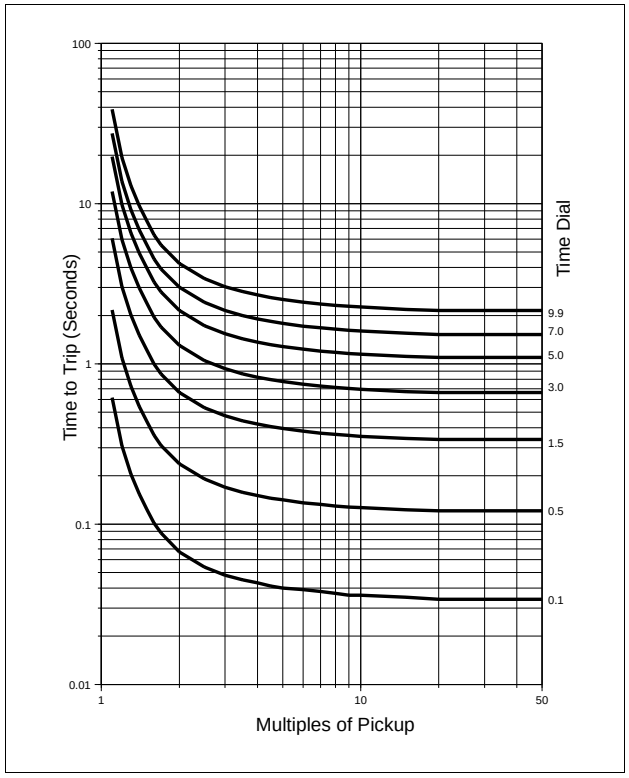


Figure A.9 Definite Inverse Curve (SEA8)

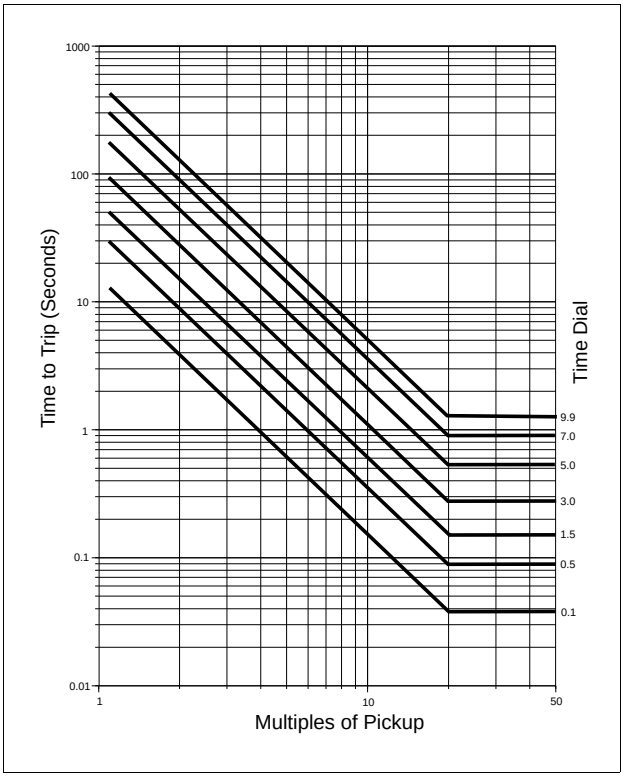


Figure A.10 I-Squared-T Curve

A

A.4 I-Squared-T Curve

The ISGS provides an I-Squared-T characteristic in addition to the standard inverse curves.

Trip Characteristic

$$T = \frac{50.7D + 10.14}{\left(\frac{i}{i_p}\right)^2}$$

Reset Characteristic

$$For\ \frac{i}{ip} < 1: \qquad T = \left| \frac{t_r D}{\left(\frac{i}{i_p}\right)^2 - 1} \right|$$

T = time to trip, in seconds

$\left(\frac{i}{i_p}\right)$ = multiple of pickup setting

D = time dial setting, 0.1 to 9.9 in steps of 0.1

t_r = reset constant = 7.4

Equation A.4 I-Squared-T Equation

A.5 Custom Protective Curve

The custom curve consists of up to 60 current-time pairs corresponding to points on the time-current characteristic curve. Current refers to multiple-of-pickup value (I/Ip) on the horizontal axis, and time refers to time-to-trip values on the vertical axis. Each point consists of two values (I/Ip and t), loaded in order from lowest to highest value of I/Ip via the SEAbus or local ports. Siemens Wisdom software is required in order to load a custom curve. Time-to-trip has a range of 0.00 to 655.35 seconds in steps of 0.01 seconds. I/Ip has a range of 1.1 to 20.00 in steps of 0.01. The first point in the data set must be I/Ip=1.1, the last point must be I/Ip=20. Points in between these two limits can be for any values of I/Ip and t as long as the slope ($\Delta t/(\Delta I/Ip)$) of the curve described by the points is between 0 (horizontal) and -∞ (vertical). For input current in excess of 20 x Ip, the relay will enter a definite time mode and the curve will be considered to be flat (constant time) at the time value associated with I/Ip=20. Once loaded, a custom curve is not adjustable, that is there is no time dial adjustment.

A.6 Over/Undervoltage Curves

The ISGS provides a moderately inverse overvoltage and a moderately inverse undervoltage protection defined by the equation in **Equation A.5** and **Equation A.6**. Their characteristics are provided in **Figure A.11** and **Figure A.12**.

Over/Undervoltage Coefficients					
Curve Type	**Des.**	**A[1]**	**B[1]**	**N[1]**	**t_r**
Inverse		0.51	-1.75	0.50	---
Mod. Inverse		0.51	-0.45	0.50	---
Very Inverse		0.51	1.75	0.50	---
[1] The A, B, and N coefficients are for the standard relay formula					

Table A.2 Under/Overvoltage Coefficients

$$For 1.01 \le \frac{v}{v_p} \le 1.5: \qquad T = \frac{AD}{\left(\frac{v}{v_p}\right)^N - 1} + BD$$

$$For \left(\frac{v}{v_p} > 1.5: \qquad T = \frac{AD}{(1.5)^N - 1} + BD\right)$$

T = time to trip, in seconds
v = measured input voltage
v_p = pickup value (tap setting)

$\left(\frac{v}{v_p}\right)$ = multiple of pickup setting

D = time dial setting, 0.1 to 9.9 in steps of 0.1
A, B, N = constants for inverse curves

Equation A.5 Overvoltage Equation

$$For\ 0.5 \le \frac{v}{v_p} \le 1.5: \qquad T = \frac{AD}{\left(\frac{v}{v_p}\right)^N - 1} + BD$$

$$For \left(\frac{v}{v_p} \le 0.5: \qquad T = \frac{AD}{(1.5)^N - 1} + BD\right)$$

T = time to trip, in seconds
v = measured input voltage
v_p = pickup value (tap setting)

$\left(\frac{v}{v_p}\right)$ = multiple of pickup setting

D = time dial setting, 0.1 to 9.9 in steps of 0.1
A, B, N = constants for inverse curves

Equation A.6 Undervoltage Equation

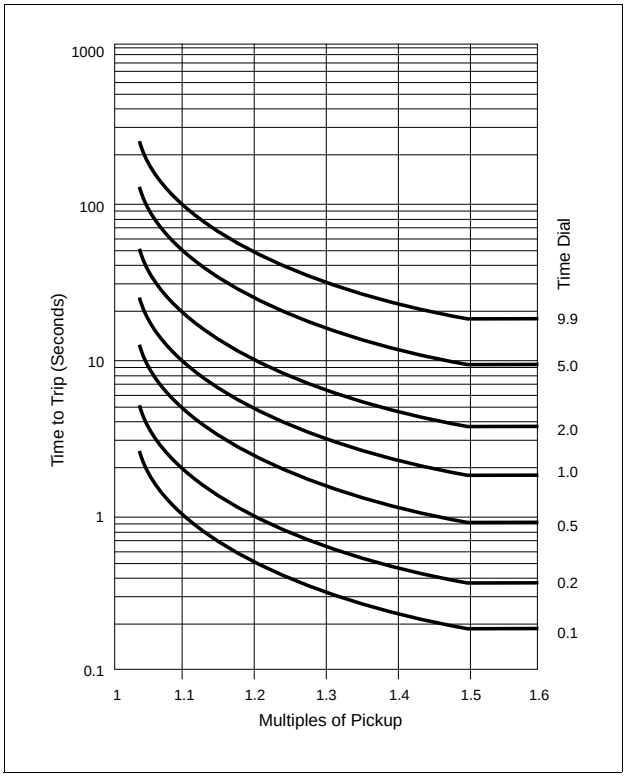


Figure A.11 Moderately Inverse Overvoltage Curve

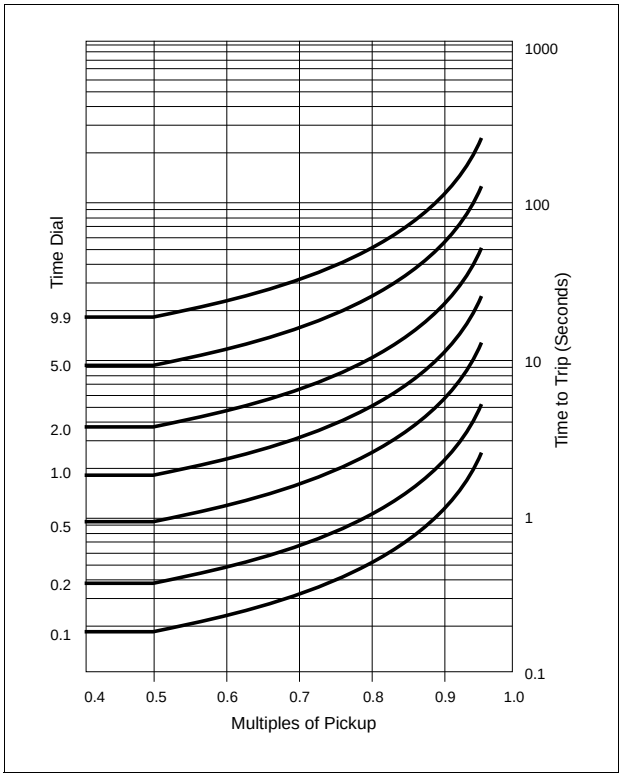


Figure A.12 Moderately Inverse Undervoltage Curve

A

B Metering

B.1 Accuracy

Table B.1 Metering Accuracies

Parameter	Range	Accuracy
rms Current (L & G)	0-250% I_n Displayed in Amperes	±1% of measurement from 50-125% of I_n ±0.5% of I_n from 10- 50% of I_n
Average rms Current	0-250% I_n Displayed in Amperes	±1% of measurement from 50-125% of I_n ±0.5% of I_n from 10-50% of I_n
Ampere Demand per Phase	0.. 250% I_n Displayed in Amperes	±1% of measurement from 50-125% of I_n ±0.5% of I_n from 10-50% of I_n
Average Ampere Demand	0-250% I_n Displayed in Amperes	±1% of measurement from 50-125% of I_n ±0.5% of I_n from 10-50% of I_n
rmsVoltage (L-L and L-N)	10-125% V_n Displayed in kV	±1% of measurement from 50-125% of V_n ±0.5% of V_n from 10-50% of V_n
Average rms Voltage	10-125% V_n Displayed in kV	±1% of measurement from 50-125% of V_n ±0.5% of V_n from 10-50% of V_n
Active Power (kW)	0-999,999.99 kW	±2% of measurement from 50-125% of P_n ±0.1% of V_n from 10-50% of P_n [1, 5]
kW Demand	0-999,999.99 kWD	±2% of measurement from 50-125% of P_n ±0.1% of V_n from 10-50% of P_n [1, 5]
kW Hours	0-999,999.99 kWHR	±2% of measurement from 50-125% of P_n ±0.1% of V_n from 10-50% of P_n [1, 3, 5]
Apparent Power (kVA)	0-999,999.99 kVA	±2% of measurement from 50-125% of P_n ±0.1% of V_n from 10-50% of P_n [1, 5]
Volt-Amperes Reactive (kVAR)	0-999,999.99 kVAR	±2% of measurement from 50-125% of P_n ±0.1% of V_n from 10-50% of P_n [1, 2, 5]
kVAR Hours	0-999,999.99 kVARH	±2% of measurement from 50-125% of P_n ±0.1% of V_n from 10-50% of P_n [1, 2, 3, 5]
Power Factor	-1- 0-+1	±0.04 [4]
Frequency	45-65 Hz	±0.1% of reading providing voltage is 50% VT primary rating

[1] Measured at PF=1. For |PF|<1, ±2% + angle error (±2% for |PF|≥0.7)
[2] Measured at PF=0. For |PF|>0, ±2% + angle error (±2% for |PF|≤0.7)
[3] Energy is accumulated in either kHR or MHR, selectable (parameter).
[4] For power factor, 1 is considered “perfect,” negative is leading and positive is lagging.
[5] $P_n = V_n \times I_n$, where V_n = VT rating (120 V) and I_n = CT rating (5A).

Note for all values: Stated accuracy applies only when the device is not in pickup. These measurements are valid over a frequency range of 45- 65Hz and include fundamental, second harmonic, and all odd harmonics up to the 13th harmonic of the fundamental line frequency.

B.2 Power Conventions

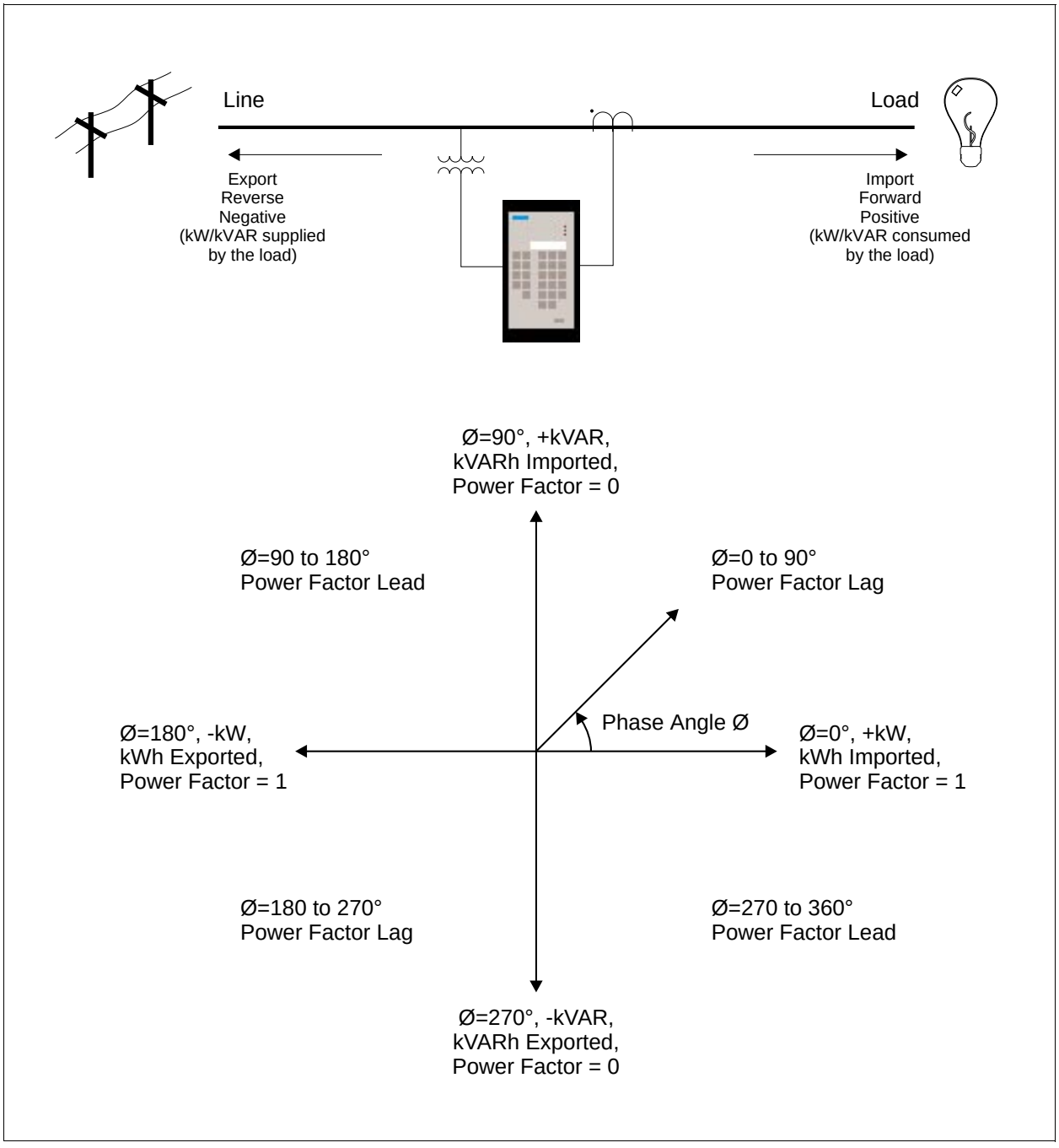


Figure B.1 Complex Power Plane

B

C Menu Structure

The following table provides a complete list of addresses and parameters available to the ISGS in its standard and optional configuration.

Functions that set the device, the CTs, or the VTs, or functions that require a change in the matrix are indicated by and asterisk (*) next to the address. Observe the warning label below when changing the settings of these functions.

⚠ WARNING

Unprotected system during reconfiguration.

If fault occurs during reconfiguration, can result in death, severe personal injury, or equipment damage.

Do not change device configuration or matrixing while the relay is in service.

Before changing device configuration, open the associated switching device and remove from service.

When the configuration or matrixing is changed, the relay may require up to 60 seconds to re-initialize and does not provide protection for the power system during the re-initialization time period.

Block	Function	Address	Parameter
0000	Power On/Configuration Display	---	---
1000 *	Device Configuration	1002 1003 1004 1005	Frequency Phase Seq. Brkr Conn. Trip Time
1100 *	CT Configuration	1101 1102 1104	Ph Pri Rtg Neu Pri Rtg Norm Pwr Flo
1200 *	VT Configuration	1201 1202 1203	Pri Rating VT Mode Secondary Rating
A1500	Instantaneous Phase Overcurrent (50) High-Set Instantaneous Phase Overcurrent (50HS)	1501 1502 1504 1510 1511 1512 1551 1552 1560 1561	Function 50 Pickup 50 Delay 50 Freeze Wfm 1 50 Freeze Wfm 2 50 Block 50 Function 50HS Pickup 50HS Freeze Wfm 1 HS Freeze Wfm 2 HS
A1600	Instantaneous Neutral or Ground Overcurrent (50N) High-Set Instantaneous Neutral or Ground Overcurrent (50HSN)	1601 1602 1604 1610 1611 1612 1651 1652 1660 1661	Function 50N Pickup 50N Time Delay 50N Freeze Wfm 1 50N Freeze Wfm 2 50N Block 50N Function HSN Pickup HSN Freeze Wfm 1HSN Freeze Wfm 2HSN
A1700	Phase Time Overcurrent (51)	1702 1703 1705 1706 1709 1710 1711 1712	Curve Pickup Time Dial Filter Reset Freeze Wfm 1 Freeze Wfm 2 Block 51
A1800	Neutral Time Overcurrent (51N)	1801 1802 1803 1805 1806 1809 1810 1811 1812	Function Curve Pickup Time Dial Filter Reset Freeze Wfm 1 Freeze Wfm 2 Block 51N
A1900	Directional Phase Time Overcurrent (67)	1901 1902 1903 1905 1906 1907 1908 1910 1911	Function Curve Pickup Time Dial Filter Impedance Direction Freeze Wfm 1 Freeze Wfm 2
A2000	Directional Neutral Time Overcurrent (67N)	2001 2002 2003 2005 2006 2007 2008 2010 2011	Function Curve Pickup Time Dial Filter Impedance Direction Freeze Wfm 1 Freeze Wfm 2
A2200	Overvoltage (59)	2201 2202 2204 2205 2206 2210 2211	Function Curve Pickup Delay (Definite) Dial (Inverse) Freeze Wfm 1 Freeze Wfm 2

Block	Function	Address	Parameter
A2300	Undervoltage (27)	2301 2302 2304 2305 2306 2310 2311	Function Curve Pickup Delay (Definite) Dial (Inverse) Freeze Wfm 1 Freeze Wfm 2
A2400	Phase Sequence Voltage (47) Negative Sequence Voltage (47N)	2401 2410 2411 2451 2452 2453 2454 2455 2456 2457 2460 2461	Function 47 Freeze Wfm1 47 Freeze Wfm2 47 Function 47N Curve 47N Pickup 47N Delay 47N Time Dial 47N Max Time 47N Block 47N Freeze Wfm1 47N Freeze Wfm2 47N
A2500	Overfrequency (810) Underfrequency (81U)	2501 2503 2504 2506 2510 2511 2551 2553 2554 2556 2560 2561	Function 810 Pickup 81O Time Delay 81O Block 81O Freeze Wfm1 81O Freeze Wfm2 81O Function 81U Pickup 81U Time Delay 81U Block 81U Freeze Wfm1 81U Freeze Wfm2 81U
2800	Breaker Failure (50B)F	2801 2802 2804 2805	Function Pickup Time Delay Check
3000	Alarm Setpoints	---	---
3100	Demand Setpoints	3101 3102 3103 3104 3105 3106 3107 3108 3109	Demand Interval Sync Time Subperiods 60 Subperiods 30 Subperiods 15 ADmd Function ADmd Pickup KWDmdFunction KWDmdPickup
3200	Power Setpoints	3201 3202 3203 3203 3204 3206 3207 3208 3209 3210 3211 3212 3213 3214	KVAR Enable KVAR Pickup KVARTime Delay KVA Enable KVA Pickup KVA Delay PF Lead Enable PF Lead Pickup PF Lead Sign PF Lead Delay PF Lag Enable PF Lag Pickup PF Lag Sign PF Lag Delay

Block	Function	Address	Parameter
3400	Analog Monitoring (Value Supervision)	3401 3402 3404 3411 3412 3414 3421 3422 3424	Function V Bal Pickup V Bal Factor V Bal Function I Sum Pickup I Sum Factor I Sum Function I Bal Pickup I Bal Factor I Bal
3500	Breaker Operation	3501 3502 3503 3504	Int. I Enable Int. I Pickup Brkr Ops Enable Brkr Ops Pickup
4000	Metering	---	---
4100	Current Metering	4101 4102 4103 4104 4105 4106 4107 4108 4109 4110	I Phase A I Phase B I Phase C I Neutral I Average I Demand, Phase A I Demand, Phase B I Demand, Phase C I Demand, Average I THD
4200	Voltages	4201 4202 4203 4204 4209	V 1-2 V 2-2 V 3-1 V L-L Average V THD
4300	Power Metering	4301 4302 4303 4304 4305 4306 4307	KW 3-Phase KW Hours KW Demand KVA 3-Phase KVAR 3-Phase KVAR Hours Power Factor
4400	Frequency Metering	4401	Frequency
4600	Current Minimum/ Maximum Log	4601 4602 4603 4604 4605 4606 4607 4608 4609 4610 4611 4612 4613 4614 4615 4616 4617 4618 4619 4620	I1 min I1 max I2 min I2 max I3 min I3 max IN min IN max IAv min IAv max I1 dem min I1 dem max I2 dem min I2 dem max I3 dem min I3 dem max IAv dem min IAv dem max MinTHD? MaxTHD

C

Appendix C: Menu Structure

Block	Function	Address	Parameter
4700	Voltage Minimum/ Maximum Log	4701 4702 4703 4704 4705 4706 4713 4714 4717 4718	V1-2 min V1-2 max V2--3 min V2-3 max V3-1 min V3-1 max VAv min VAv max Min THD Max THD
4800	Power Minimum/ Maximum Log	4801 4802 4803 4804 4805 4806 4807 4808 4809 4810	kW min kW max kW dem min kW dem max kVA min kVA max kVAR min kVAR max PF max PF min
4900	Frequency Mini-mum/Maximum Log	4901 4902	Frequency min Frequency max
5000	Trip Logs	---	---
5100 (most recent) thru 5800 (oldest)	Trip Log Information **Note:** Access address block first, then scroll to desired 3-digit address	(001) (002) (003) (004) (005) (006) (007) (008) (009) (010) (011) (012) (013) (014) (015) (016) (017) (019) (020) (021) (022) (023)	Trip # Time in Pickup Pickup Function Phase (at Pickup) I1 (at Pickup) I2 (at Pickup) I3 (at Pickup) IN (at Pickup) V1 (at Pickup) V2 (at Pickup) V3 (at Pickup) Trip Function Phase (at Trip) I1 (at Trip) I2 (at Trip) I3 (at Trip) IN (at Trip) V1 (at Trip) V2 (at Trip) V3 (at Trip) TinPU Trip Log full
6000 *	Matrixing	---	---
6100 *	Binary Inputs	6101 6102 6103 6104	Input 1 Input 2 Input 3 Input 4
6200 *	Binary Outputs	6201 6202	Output 1 Output 2
6400 *	Trip Contacts	6401 6402 6403	Contact 1 Contact 2 Contact 3

Block	Function	Address	Parameter
7000	Operating Parameters	7005 7006	LCD Line 1 LCD Line 2
7100	Parameter Set	7101 7103 7104 7105 7106 7107	Active Set Activation Copy? Defaults to A Copy? Defaults to B Copy? A to B Copy? B to A
7200	Configure Comm Port SEAbus	7201 7202 7203 7204 7207	Local Port System Port ParaChange Com Events Local Address
7300	Configure Passwords	7301 7302 7303	CW Level 1 CW Level 2 CW Level 3
7400	Relay Data	7401 7402 7403 7404 7405 7406 7407 7408 7409	Circuit Name MainBd S/N MainBd ID OptBd 1 S/N OptBd 1 ID OptBd 2 S/N OptBd 2 ID Bin. Inputs Bin. Outputs
8000	Other Settings	---	---
8100	Date and Time Setting	8101 8102 8103	Current Date Date Time
8200	Reset	8201 8202 8203 8204 8205 8211 8212 8213 8214	Trip Log Min/Max Values? Energy Breaker Ops SumCurrInter Breaker Ops Sum IL1 Sum IL2 Sum IL3
8300	Breaker Monitoring	8301 8302 8303 8304 8305	TripSrcImp TripSrcFail TrpCoil Cont TrpCoilFail BrkrMech
8400	Waveform Capture	8401 8402	Wfm1 Pre-Trip Wfm2 Pre-Trip

C

D Acceptance Test Procedures

When performing the acceptance tests, follow the sequence listed here; first test protective function 51, then 50, etc.)

Note: The following procedures should be performed using accurately calibrated test equipment connected to a source free of harmonics. Refer to Figure D.1 for connection diagram.

ISGS Acceptance Test — Phase Time Overcurrent (51) Function

Set the ISGS as follows:

Parameter Set A	7103
5000:5 Current Transformer (CT)	1101
Curve SEA 5, Very Inverse	1702
1 A Nominal Pickup	1703
Time Dial per Chart	1705
Trip Matrixed to Trip 1 Contact	6401
Disable Other Conflicting Functions	1501, 1551, 1601, 1651, 1801, 1901, 2001, 2301

Phase A	Phase B	Phase C	
			Connections
☐	☐	☐	1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).
☐	☐	☐	Relay Disabled contact on terminals 19 and 20 opens.
			2. Connect suitable variable source current
☐	☐	☐	to phase A, terminals 3 and 4,
☐	☐	☐	to phase B, terminals 5 and 6,
☐	☐	☐	to phase C, terminals 7 and 8,
☐	☐	☐	to neutral, terminals 9 and 10.
☐	☐	☐	3. Connect timer to Trip 1 contacts, terminals 1 and 2.
			Pickup
☐	☐	☐	4. Increase current until relay picks up (this should occur at 1.06 x pickup.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	Return current to zero and reset timer.
			Timing
☐	☐	☐	5. Apply appropriate value of current for the test. The results match **Table D.1**.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Display shows PICKUP 51 P1 (2, 3).
☐	☐	☐	Wisdom software records pickup in event log.

ISGS Acceptance Test (continued)

Phase Time Overcurrent (51) Function

Phase A	Phase B	Phase C	
☐	☐	☐	6. Relay times out per **Table D.1**.
☐	☐	☐	Trip LED illuminates.
☐	☐	☐	Timer stops as Trip 1 contacts close.
☐	☐	☐	Trip log indicates trip current value and time in pickup.
☐	☐	☐	Wisdom software records trip on overcurrent.
☐	☐	☐	Return current to zero and reset timer.
☐	☐	☐	7. Remove control power from relay for five seconds, then restore it.
☐	☐	☐	Trip LED re-illuminates after relay is powered up again.
☐	☐	☐	8. Reset relay target.
☐	☐	☐	Trip LED resets.

Repeat above steps for phase B and phase C; repeat the same steps also for Parameter Set B.
Testing may also be done for each phase at the user settings following the same procedure.

Table D.1 Test Points for Very Inverse Curve Characteristics

Multiple of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
2X	3.73	9.30	18.38
4X	0.92	2.27	4.46
8X	0.40	0.96	1.87
Accuracy of the time curve for 2 ≤ I/Ip ≤ 20 is 5% from the defined value, or 30 ms, whichever is greater.			

D

ISGS Acceptance Test

Neutral Time Overcurrent (51N) Function

Set the ISGS as follows:

Parameter Set A	7103
5000:5 Current Transformer (CT)	1102
Curve SEA 5, Very Inverse	1802
1 A Nominal Pickup	1803
Time Dial per Chart	1805
Trip Matrixed to Trip 1 Contact	6401
Enable 51N	1801
Disable Other Conflicting Functions	1501, 1551, 1601, 1651, 1901, 2001, 2301
Raise 51 Pickup to Maximum	1703

Phase N Connections

- ☐ 1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).
- ☐ Relay Disabled contact on terminals 19 and 20 opens.
- ☐ 2. Connect suitable variable source current to neutral, terminals 9 and 10.
- ☐ 3. Connect timer to Trip 1 contacts, terminals 1 and 2.

Pickup

- ☐ 4. Increase current until relay picks up (this should occur at 1.06 A x pickup).
- ☐ Pickup LED illuminates.
- ☐ Wisdom software records pickup in event log.
- ☐ Return current to zero and reset timer.

Timing

- ☐ 5. Apply appropriate value of current for the test. The results match **Table D.2**.
- ☐ Pickup LED illuminates.
- ☐ Display shows PICKUP 51N PN.
- ☐ Wisdom software records pickup in event log.

ISGS Acceptance Test (continued)

Neutral Time Overcurrent (51N) Function

Phase
N

- ☐ 6. Relay times out per **Table D.2**.
- ☐ Trip LED illuminates.
- ☐ Timer stops as Trip 1 contacts close.
- ☐ Trip log indicates trip current value and time in pickup.
- ☐ Wisdom software records trip on overcurrent.
- ☐ Return current to zero and reset timer.
- ☐ 7. Remove control power from relay for five seconds, then restore it.
- ☐ Trip LED re-illuminates after relay is powered up again.
- ☐ 8. Reset relay target.
- ☐ Trip LED resets.

Repeat the same steps also for Parameter Set B.
Testing may also be done for the user settings following the same procedure.

Table D.2 Test Points for Very Inverse Curve Characteristics

Multiple of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
2X	3.73	9.30	18.38
4X	0.92	2.27	4.46
8X	0.40	0.96	1.87
Accuracy of the time curve for 2 ≤ I/Ip ≤ 20 is 5% from the defined value, or 30 ms, whichever is greater.			

D

ISGS Acceptance Test

Instantaneous Phase Overcurrent (50) Function

Set the ISGS as follows:

Parameter Set A	7103
5000:5 Current Transformer (CT)	1102
Curve SEA 5, Very Inverse	1702
20 A Nominal Pickup	1703
Time Dial 9.9	1705
Instantaneous Pickup 1 A	1501, 1502, 1503
Instantaneous Time Delay 0.0	1504
Trip Matrixed to Trip 1 Contact	6401

Phase A	Phase B	Phase C	
			Connections
☐	☐	☐	1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).
			2. Connect suitable variable source current
☐	☐	☐	to phase A on terminals 3 and 4,
☐	☐	☐	to phase B on terminals 5 and 6,
☐	☐	☐	to phase C on terminals 7 and 8.
☐	☐	☐	3. Connect a timer to the trip contacts on terminals 1 and 2.
			Pickup
☐	☐	☐	4. Apply a current approximately 75% of the instantaneous pickup.
☐	☐	☐	5. Raise the current and note the value of current at which the relay trips.
☐	☐	☐	Trip LED illuminates.
☐	☐	☐	Timer stops on trip.
☐	☐	☐	Display shows TRIP 50 P1 (2, 3).
☐	☐	☐	Trip log shows TRIP 50 P1 (2, 3) and the correct date and time.
☐	☐	☐	Trip log shows value of current at trip.
☐	☐	☐	Wisdom software records trip in event log.
☐	☐	☐	Return current to zero and reset timer.
☐	☐	☐	6. Set value of current slightly above Instantaneous Overcurrent pickup and record time required to trip.

Repeat above steps for phase B and phase C; repeat the same steps also for Parameter Set B.
Tests may be repeated at required settings.

CAUTION: Extended testing at high current levels may damage the relay. Note ratings (Maximum Input Current) in Chapter 1, Section 1.5, *Test Specifications*.

D

ISGS Acceptance Test

Undervoltage (27) Function

Set the ISGS as follows:

Parameter Set A	7103
Voltage Primary Rating 120 V	1201
Connection Line to Neutral	1202
Enable Function	2301
Time Characteristic: Inverse Time	2302
Trip on Line to Neutral	2303
Pickup Level 100 V	2304
Time Dial 5.0	2306
Trip Matrixed to Trip 1 Contact	6401

Phase A	Phase B	Phase C	
			Connections
			1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).
			Relay Disabled contact on terminals 19 and 20 opens.
			With 27 enabled, pickup LED is illuminated; relay may trip on Undervoltage before VT source is applied.
			2. Connect suitable variable voltage source to terminals 41, 43, and 45 with
			neutral connected to 42, 44, and 46.
			3. Connect timer to Trip 1 contacts on terminals 1 and 2.
			Pickup
			4. Apply nominal to neutral system voltage.
			Pickup LED extinguishes.
			Trip LED may be reset.
			5. Slowly reduce voltage until relay picks up.
			Pickup LED illuminates.
			Display shows PICKUP 27 P1 (2, 3).
			Wisdom software records pickup in event log.
			6. Return voltage to nominal value.
			Pickup LED extinguishes.
			Wisdom software records end of pickup.

D

ISGS Acceptance Test (continued)

Undervoltage (27) Function

Phase A	Phase B	Phase C	Timing
☐	☐	☐	7. Set voltage per **Table D.3**.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Display shows PICKUP 27 P1 (2, 3).
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	8. Relay times out per **Table D.3**.
☐	☐	☐	Trip LED illuminates.
☐	☐	☐	Timer stops as Trip 1 contacts close.
☐	☐	☐	Trip log indicates trip voltage value and time in pickup.
☐	☐	☐	Wisdom software records relay trip on Undervoltage.
☐	☐	☐	Return voltage to nominal and reset timer.
☐	☐	☐	9. Remove control power from relay for five seconds; then restore it.
☐	☐	☐	Trip LED re-illuminates after relay is powered up again.
☐	☐	☐	10. Reset the relay target.
☐	☐	☐	Trip LED resets.

Repeat above steps for phase B and phase C; repeat the same steps also for Parameter Set B.
Testing may also be done at the user settings following the same procedure.

Table D.3 Test Points for Inverse Undervoltage Curve Characteristics

Percent of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
90	20.00	50.00	99.00
75	7.74	19.35	38.32
50	3.64	9.10	18.01
0	1.56	3.91	7.73
Accuracy of the time curve for 2 ≤ I/Ip ≤ 20 is 5% from the defined value, or 30 ms, whichever is greater.			

D

ISGS Acceptance Test

Overvoltage (59) Function

Set the ISGS as follows:

Parameter Set A	7103
Voltage Primary Rating 120 V	1201
Connection Line to Neutral	1202
Enable Function	2201
Time Characteristic: Inverse Time	2202
Trip on Line to Neutral	2203
Pickup Level 100 V	2204
Time Dial per Table	2206
Trip Matrixed to Trip 1 Contact	6401

Phase A	Phase B	Phase C	
			Connections
☐	☐	☐	1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).
☐	☐	☐	Relay Disabled contact on terminals 19 and 20 opens.
☐	☐	☐	2. Connect suitable variable voltage source to terminals 41, 43, and 45 with
☐	☐	☐	neutral connected to 42, 44, and 46.
☐	☐	☐	3. Connect a timer to the Trip 1 contacts on terminals 1 and 2.
			Pickup
☐	☐	☐	4. Apply nominal to neutral system voltage.
☐	☐	☐	Pickup LED extinguishes.
☐	☐	☐	Trip LED may be reset.
☐	☐	☐	5. Slowly increase voltage until relay picks up.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Display shows PICKUP 59 P1 (2, 3).
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	6. Return voltage to nominal value.
☐	☐	☐	Pickup LED extinguishes.
☐	☐	☐	Wisdom software records end of pickup.

D

ISGS Acceptance Test (continued)

Overvoltage (59) Function

Phase A	Phase B	Phase C	Timing
☐	☐	☐	7. Set voltage per **Table D.4**.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Display shows PICKUP 59 P1 (2, 3).
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	8. Relay times out per **Table D.4**.
☐	☐	☐	Trip LED illuminates.
☐	☐	☐	Timer stops as Trip 1 contacts close.
☐	☐	☐	Trip log indicates trip voltage value and time in pickup.
☐	☐	☐	Wisdom software records relay trip on Overvoltage.
☐	☐	☐	Return voltage to nominal and reset timer.
☐	☐	☐	9. Remove control power from relay for five seconds; then restore it.
☐	☐	☐	Trip LED re-illuminates after relay is powered up again.
☐	☐	☐	10. Reset relay target.
☐	☐	☐	Trip LED resets.

Repeat above steps for phase B and phase C; repeat the same steps also for Parameter Set B.
Testing may also be done at the user settings following the same procedure.

Table D.4 Test Points for Inverse Overvoltage Curve Characteristics

Percent of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
110	20.00	50.00	99.00
125	7.74	19.35	38.32
150	3.64	9.10	18.01
>150	1.56	3.91	7.73
Accuracy of the time curve for 2 ≤ I/Ip ≤ 20 is 5% from the defined value, or 30 ms, whichever is greater.			

D

ISGS Acceptance Test

Directional Phase Time Overcurrent (67) Function
(Phase-Neutral Connected VTs)

Set the ISGS as follows:

Parameter Set A	7103
5000:5 Current Transformer (CT)	1101
Curve SEA 5, Very Inverse	1902
1 A Nominal Pickup	1903
Time Dial per Chart	1905
Impedance to 45°	1907
Direction to Reverse	1908
Trip Matrixed to Trip 1 Contact	6401
Enable 67	1901
Disable Other Conflicting Functions	1501, 1551, 1601, 1651, 1801, 1901, 2001, 2301
Raise 51 Pickup to Maximum	1703

Phase

A B C **Connections**

☐☐☐ 1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).

☐☐☐ Relay Disabled contact on terminals 19 and 20 opens.

2. Connect suitable variable source current

☐☐☐ to phase A, terminals 3 and 4,

☐☐☐ to phase B, terminals 5 and 6,

☐☐☐ to phase C, terminals 7 and 8,

3. Connect suitable AC voltage

☐☐☐ to phase A, terminals 41 and 42,

☐☐☐ to phase B, terminals 43 and 44,

☐☐☐ to phase C, terminals 45 and 46,

☐☐☐ Connect timer to Trip 1 contacts, terminals 1 and 2.

Pickup

☐☐☐ 4. Apply nominal voltage to the relay's voltage inputs,
for example, 69 V ∠ 0 to phase A,
69 V ∠ 240 to phase B,
69 V ∠ 120 to phase C.

☐☐☐ Apply 2x pickup current to phase A and B in **forward** direction,
for example, 2.0 A ∠ 30 to phase A and 2.0 A ∠ 210 to phase B, or
2.0 A ∠ 270 to phase B and 2.0 A ∠ 90 to phase C, or
2.0 A ∠150 to phase C and 2.0 A ∠ 330 to phase A.

☐☐☐ -relay should **not** go into pickup,

☐☐☐ -reset test current to zero A,

☐☐☐ -increase phase A and phase B current in **reverse** direction until relay picks up (at 1.06 x pickup)
for example, 1.06 A ∠ 210 to phase A and 1.06 A ∠ 30 to phase B, or
1.06 A ∠ 90 to phase B and 1.06 A ∠ 270 to phase C, or
1.06 A ∠ 330 to phase C and 1.06 A ∠ 150 to phase A.

ISGS Acceptance Test
(continued)

Directional Phase Time Overcurrent (67) Function
(Phase-Neutral Connected VTs)

Phase A	Phase B	Phase C	
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	Return current to zero and reset timer.

Timing

☐	☐	☐	5. Apply appropriate value of current in reverse direction for the test. The results match **Table D.5**.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Display shows PICKUP 67 P12 (23, 31).
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	6. Relay times out per **Table D.5**.
☐	☐	☐	Trip LED illuminates.
☐	☐	☐	Timer stops as Trip 1 contacts close.
☐	☐	☐	Trip log indicates trip current value and time in pickup.
☐	☐	☐	Wisdom software records trip on directional overcurrent.
☐	☐	☐	Return current to zero and reset timer.
☐	☐	☐	7. Remove control power from relay for five seconds, then restore it.
☐	☐	☐	Trip LED re-illuminates after relay is powered up again.
☐	☐	☐	8. Reset relay target.
☐	☐	☐	Trip LED resets.

D

Repeat above steps for phase B-C and phase C-A; repeat the same steps also for Parameter Set B.
Testing may also be done for each phase at the user settings following the same procedure.

Table D.5 Test Points for Very Inverse Curve Characteristics

Multiple of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
2X	3.73	9.30	18.38
4X	0.92	2.27	4.46
8X	0.40	0.96	1.87
Accuracy of the time curve for $2 \leq I/Ip \leq 20$ is 5% from the defined value, or 30 ms, whichever is greater.			

ISGS Acceptance Test

Directional Phase Time Overcurrent (67) Function
(Phase-Phase Connected VTs)

Set the ISGS as follows:

Parameter Set A	7103
5000:5 Current Transformer (CT)	1101
Curve SEA 5, Very Inverse	1902
1 A Nominal Pickup	1903
Time Dial per Chart	1905
Impedance to 45°	1907
Direction to Reverse	1908
Trip Matrixed to Trip 1 Contact	6401
Enable 67	1901
Disable Other Conflicting Functions	1501, 1551, 1601, 1651, 1801, 1901, 2001, 2301
Raise 51 Pickup To Maximum	1703

Phase A	Phase B	Phase C	
			Connections
☐	☐	☐	1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).
☐	☐	☐	Relay Disabled contact on terminals 19 and 20 opens.
			2. Connect suitable variable source current
☐	☐	☐	to phase A, terminals 3 and 4,
☐	☐	☐	to phase B, terminals 5 and 6,
☐	☐	☐	to phase C, terminals 7 and 8,
☐	☐	☐	to neutral, terminals 9 and 10,
			3. Connect suitable AC voltage
☐	☐	☐	to phase A-B, terminals 41 and 42,
☐	☐	☐	to phase B-C, terminals 43 and 44,
☐	☐	☐	to phase C-A, terminals 45 and 46,
☐	☐	☐	Connect timer to Trip 1 contacts, terminals 1 and 2.
			Pickup
☐	☐	☐	4. Apply nominal voltage to the relay's voltage inputs, for example, 69 V ∠ 30 to phase A-B, 69 V ∠ 270 to phase B-C, 69 V ∠ 150 to phase C-A.
☐	☐	☐	Apply 2x pickup current to phase A and B in **forward** direction, for example, 2.0 A ∠ 30 to phase A and 2.0 A ∠ 210 to phase B, or 2.0 A ∠ 270 to phase B and 2.0 A ∠ 90 to phase C, or 2.0 A ∠150 to phase C and 2.0 A ∠ 330 to phase A.
☐	☐	☐	-relay should **not** go into pickup,
☐	☐	☐	-reset test current to zero A,

D

ISGS Acceptance Test
(continued)

Directional Phase Time Overcurrent (67) Function
(Phase-Phase Connected VTs)

Phase A	Phase B	Phase C	
☐	☐	☐	-increase phase A current in the **reverse** direction until relay picks up. This should occur at 1.06 x pickup, for example, 1.06 A ∠ 210 to phase A and 1.06 A ∠ 30 to phase B, or 1.06 A ∠ 90 to phase B and 1.06 A ∠ 270 to phase C, or 1.06 A ∠ 330 to phase C and 1.06 A ∠ 150 to phase A.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	Return current to zero and reset timer.

Timing

☐	☐	☐	5. Apply appropriate value of current in reverse direction for the test. The results match **Table D.6**.
☐	☐	☐	Pickup LED illuminates.
☐	☐	☐	Display shows PICKUP 67 P12 (23, 31).
☐	☐	☐	Wisdom software records pickup in event log.
☐	☐	☐	6. Relay times out per **Table D.6**.
☐	☐	☐	Trip LED illuminates.
☐	☐	☐	Timer stops as Trip 1 contacts close.
☐	☐	☐	Trip log indicates trip current value and time in pickup.
☐	☐	☐	Wisdom software records trip on directional overcurrent.
☐	☐	☐	Return current to zero and reset timer.
☐	☐	☐	7. Remove control power from relay for five seconds, then restore it.
☐	☐	☐	Trip LED re-illuminates after relay is powered up again.
☐	☐	☐	8. Reset relay target.
☐	☐	☐	Trip LED resets.

Repeat above steps for phase B-C and phase C-A; repeat the same steps also for Parameter Set B.
Testing may also be done for each phase at the user settings following the same procedure.

Table D.6 Test Points for Very Inverse Curve Characteristics

Multiple of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
2X	3.73	9.30	18.38
4X	0.92	2.27	4.46
8X	0.40	0.96	1.87
Accuracy of the time curve for 2 ≤ I/Ip ≤ 20 is 5% from the defined value, or 30 ms, whichever is greater.			

ISGS Acceptance Test

Directional Neutral Time Overcurrent (67N) Function

(Only Available with Phase-Neutral Connected VTs)

Set the ISGS as follows:

Parameter Set A	7103
5000:5 Current Transformer (CT)	1102
Curve SEA 5, Very Inverse	2002
1 A Nominal Pickup	2003
Time Dial per Chart	2005
Impedance to 45°	1907
Direction to Reverse	1908
Trip Matrixed to Trip 1 Contact	6401
Enable 67	2001
Disable Other Conflicting Functions	1501, 1551, 1601, 1651, 1801, 1901, 2001, 2301
Raise 51 Pickup to Maximum	1703

Phase

N **Connections**

☐ 1. Connect the appropriate source of control voltage to terminals 13 (+) and 12 (-).

☐ 2. Relay Disabled contact on terminals 19 and 20 opens.

3. Connect suitable variable source current

☐ to phase A, terminal 3,

☐ to phase B, terminal 5,

☐ to phase C, terminal 7,

☐ Connect terminals 4, 6, and 8 to terminal 9.

☐ Connect terminal 10 to the common of the current sources.

4. Connect suitable AC voltage

☐ to phase A, terminals 41 and 42,

☐ to phase B, terminals 43 and 44,

☐ to phase C, terminals 45 and 46,

☐ Connect timer to Trip 1 contacts, terminals 1 and 2.

Pickup

☐ 5. Apply nominal voltage to the relay's voltage inputs, for example,
for example, 69 V ∠ 0 to phase A,
69 V ∠ 240 to phase B,
69 V ∠ 120 to phase C.

☐ Apply 2x pickup current to phase A in forward direction, for example,
for example, 2.0 A ∠ 0 to phase A,
2.0 A ∠ 240 to phase B,
2.0 A ∠120 to phase C.

☐ -relay should **not** go into pickup,

☐ -reset test current to zero A,

D

ISGS Acceptance Test
(continued)

Directional Neutral Time Overcurrent (67N) Function
(Only Available with Phase-Neutral Connected VTs)

Phase
N

☐ -increase phase A current in the reverse direction until relay picks up. This should occur at 1.06 x pickup, for example, 1.06 A ∠ 180 to phase A,
1.06 A ∠ 60 to phase B,
1.06 A ∠ 300 to phase C.

☐ Pickup LED illuminates.

☐ Wisdom software records pickup in event log.

☐ Return current to zero and reset timer.

Timing

☐ 6. Apply appropriate value of current in reverse direction for the test. The results match **Table D.7**.

☐ Pickup LED illuminates.

☐ Display shows PICKUP 67N PN.

☐ Wisdom software records pickup in event log.

☐ 7. Relay times out per **Table D.7**.

☐ Trip LED illuminates.

☐ Timer stops as Trip 1 contacts close.

☐ Trip log indicates trip current value and time in pickup.

☐ Wisdom software records trip on directional overcurrent.

☐ Return current to zero and reset timer.

☐ 8. Remove control power from relay for five seconds, then restore it.

☐ Trip LED re-illuminates after relay is powered up again.

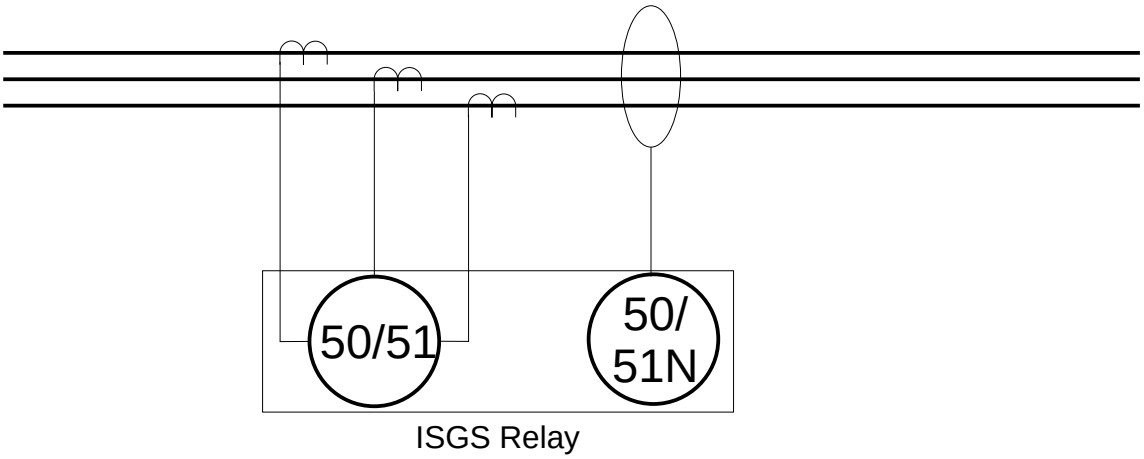
☐ 9. Reset relay target.

☐ Trip LED resets.

Repeat above steps for phase B and phase C; repeat the same steps also for Parameter Set B.
Testing may also be done for each phase at the user settings following the same procedure.

Table D.7 Test Points for Very Inverse Curve Characteristics

Multiple of Pickup	Time Band 2 (seconds)	Time Band 5 (seconds)	Time Band 9.9 (seconds)
2X	3.73	9.30	18.38
4X	0.92	2.27	4.46
8X	0.40	0.96	1.87
Accuracy of the time curve for 2 ≤ I/Ip ≤ 20 is 5% from the defined value, or 30 ms, whichever is greater.			



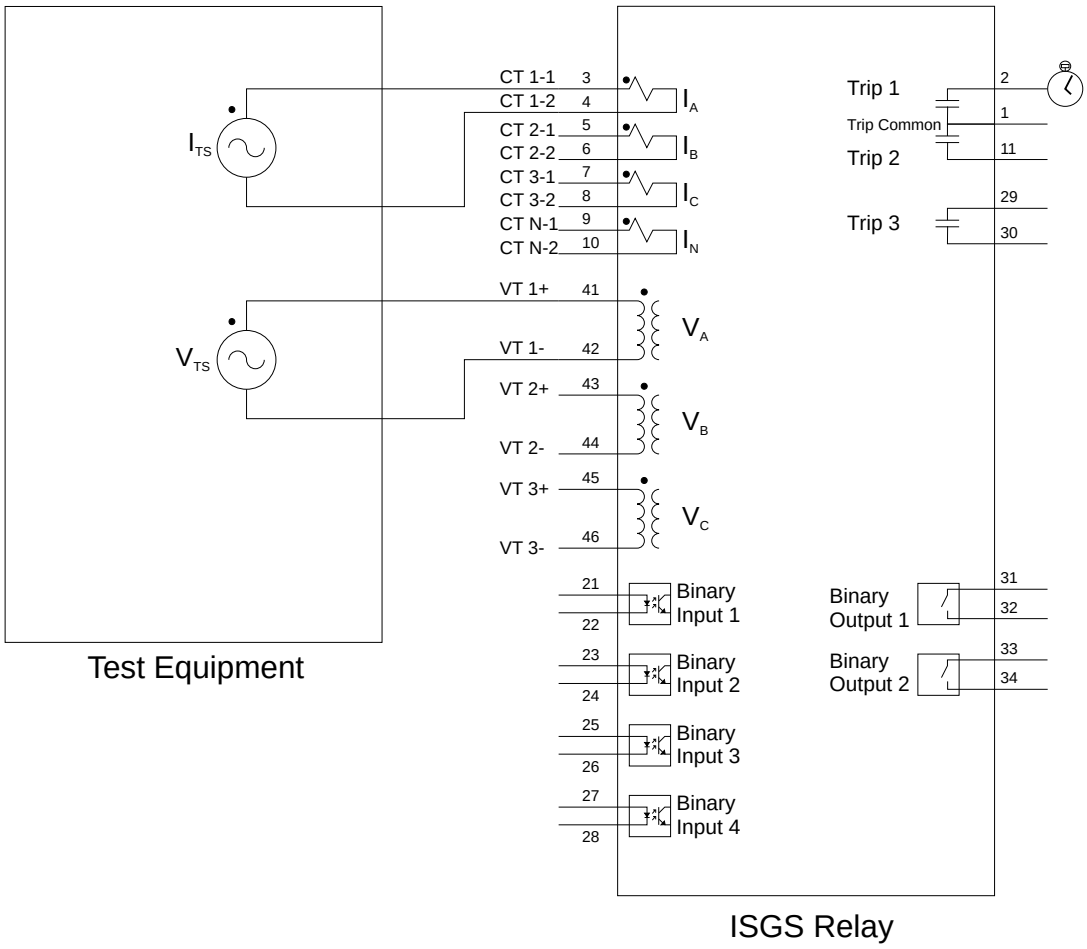


Figure D.1 Terminal Connections for Test Procedures

E Schematics

E.1 DC Trip System

The following diagram illustrates a typical connection scheme for the ISGS relay when using a DC trip system.

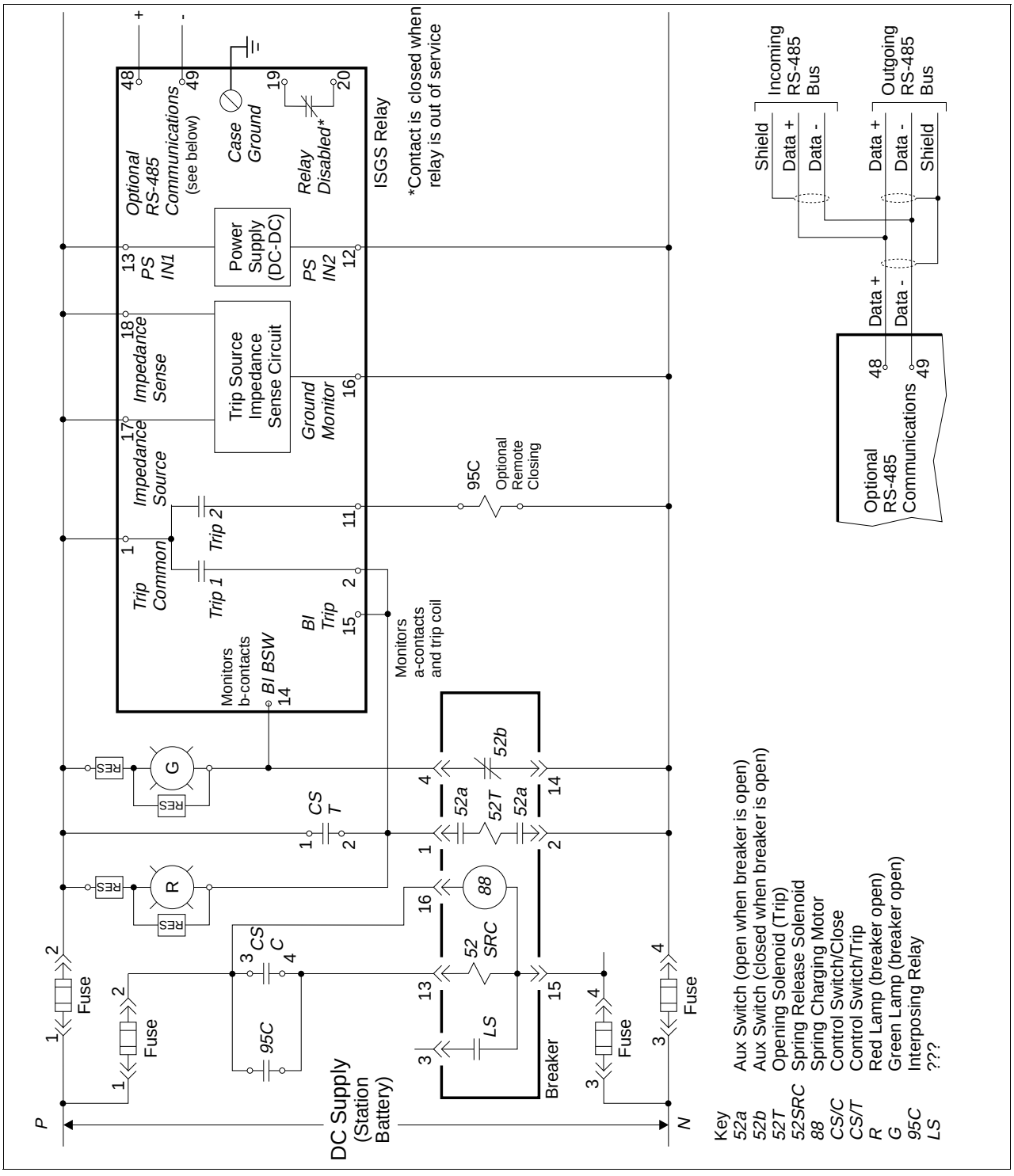


Figure E.1 Wiring for DC Trip Systems

E.2 AC (Capacitor) Trip Systems

The following diagram illustrates a typical connection scheme for the ISGS relay when using an AC trip system.

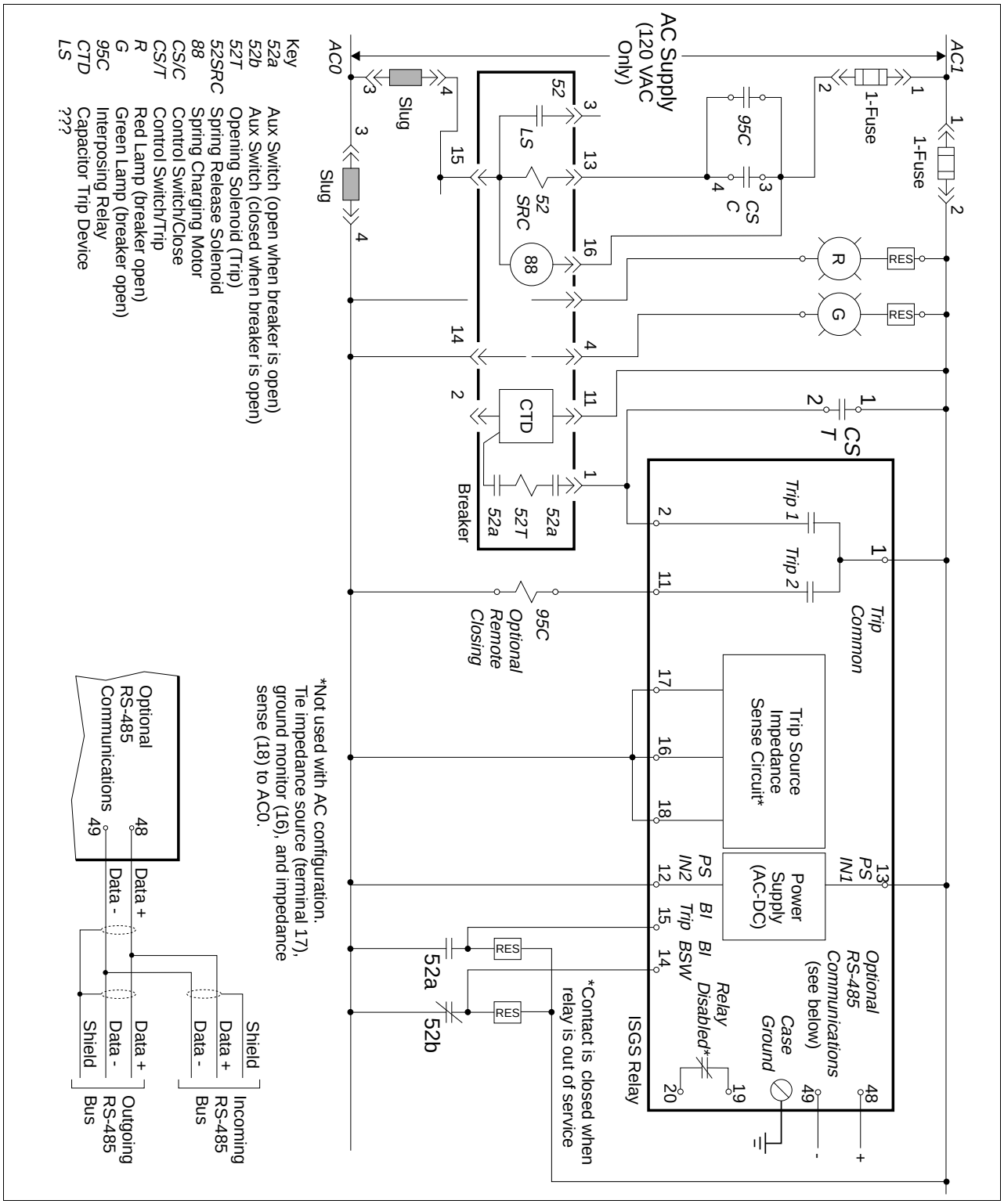


Figure E.2 Wiring for AC (Capacitor) Trip System

ISGS Settings Worksheet for Date: Set A

This ISGS settings worksheet allows easy recording of the desired ISGS parameter settings when configuring the device manually with the keypad controls.

Functions and parameters are listed in numerical sequence of their address blocks and addresses just as they appear on the LCD. Where applicable, value ranges and resolution are provided for easy reference. Only configurable functions and parameters are listed. For a complete list refer to the ISGS relay menu in **Appendix C**.

Before configuring the device, copy this form and enter the desired configuration data. Include the device identification number (device version number and its catalog number on front panel label; or line 1 and line 2 of Power On display) and the date of configuration. Then simply circle the desired settings and enter numerical values in the blank spaces provided. Boldfaced settings indicate factory defaults. For indicating matrix settings, draw a line from the matrix position number to the desired setting and circle the setting.

Take special care in copying lines 1 and 2 of the relay's Power On display (refer to **Section 4.1**). The information displayed in these two lines provides Siemens with detailed information about the device in the event you encounter a problem and have to contact Siemens customer service.

After entering all data on this configuration form, take it to the device and enter the information into the relay. This form allows for the recording of both parameter sets. After completing this form, file it for future reference.

0000	**Power On Display (enter display)**						
----	Line 1						
----	Line 2						
1000	**Device Configuration**						
1002	Frequency	**60 Hz**			50 Hz		
1003	Phase Sequence	**123 (ABC)**			132 (ACB)		
1004	Breaker Connection	**Trip1**	Trip2	Trip3	Trips 1&2	Trips1&3	Trips 123
1005	Trip Time	**0.1 s**	Range: 0.01-32 s (0.01 s steps)			s	
1100	**Current Transformer Configuration**						
1101	Phase CT Primary Rating	**1200 A**		Range: 5-8000 A (1 A steps)		A	
1102	Neutral CT Primary Rating	**1200 A**		Range: 5-8000 A (1 A steps)		A	
1104	Power Flow	**Normal**			Reverse		
1200	**Voltage Transformer Configuration**						
1201	Primary Rating	**12000 V**	Range: 120-138000 V (1 V steps)			V	
1202	VT Mode	**Line-to-Line**			Line-to-Neutral		
1203	Secondary VT Rating	**120 V**	Range: 100-120 V (1 V steps)			V	

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A1500	**Instantaneous Phase Overcurrent (50) High-Set Instantaneous Phase Overcurrent (50HS)**				
A1501	Function 50	**Enabled**		Disabled	
A1502	Pickup 50 5 A CT	**1.0 A**	Range: 1-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
A1504	Time Delay 50	**0.00 s**	Range: 0-60 s (0.01 s steps)		s
1510	Freeze Waveform 1 50	on pickup	**on Trip**	None	
1511	Freeze Waveform 2 50	on pickup	on Trip	**None**	
A1512	Block 50 by	**None**	50HS & 50HSN	50HS	50HSN
A1551	Function 50HS	**Enabled**		Disabled	
A1552	Pickup 50HS 5 A CT	**5.0 A**	Range: 5-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
1560	Freeze Waveform 1 50HS	---	**on Trip**	None	
1561	Freeze Waveform 2 50HS	---	on Trip	**None**	
A1600	**Instantaneous Neutral or Ground Overcurrent (50N) High-Set Instantaneous Neutral or Ground Overcurrent (50HSN)**				
A1601	Function 50N	**Enabled**		Disabled	
A1602	Pickup 50N 5 A CT	**1.0 A**	Range: 1-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
A1604	Time Delay 50N	**0.00 s**	Range: 0-60 s (0.01 s steps)		s
1610	Freeze Waveform 1 50N	on Pickup	**on Trip**	None	
1611	Freeze Waveform 2 50N	on Pickup	on Trip	**None**	
A1612	Block 50N by	**None**	50HS & 50HSN	50HS	50HSN
A1651	Function 50HSN	**Enabled**		Disabled	
A1652	Pickup 50HSN 5 A CT	**5.0 A**	Range: 5-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
1660	Freeze Waveform 1 50HSN	---	**on Trip**	None	
1661	Freeze Waveform 2 50HSN	---	on Trip	**None**	

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A1700	**Phase Time Overcurrent (51)**				
A1702	Curve 51	Inverse	Short Inverse	Long Inverse	Moderately Inverse
		Custom	**Very Inverse**	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
A1703	Pickup 51 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	(PU point is 1.06 of PU setting). 1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
A1705	Time Dial 51	**0.1**	Range: 0.1-9.9 (0.1 steps)		
A1706	Filter 51	**rms**		fundamental	
A1709	Reset 51	Disk Emulation		**Instantaneous**	
1710	Freeze Waveform 1 51	on Pickup	**on Trip**	None	
1711	Freeze Waveform 2 51	on Pickup	on Trip	**None**	
A1712	Block 51 by	**None**	50HS & 50HSN	50HS	50HSN
A1800	**Neutral Time Overcurrent (51N)**				
A1801	Function 51N	**Enabled**		Disabled	
A1802	Curve 51N	**Inverse**	Short Inverse	Long Inverse	Moderately Inverse
		Custom	Very Inverse	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
A1803	Pickup 51N 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
A1805	Time Dial 51N	**0.1**	Range: 0.1-9.9 (0.1 steps)		
A1806	Filter 51N	**rms**		fundamental	
A1809	Reset 51N	Disk Emulation		**Instantaneous**	
1810	Freeze Waveform 1 51N	on Pickup	**on Trip**	None	
1811	Freeze Waveform 2 51N	on Pickup	on Trip	**None**	
A1812	Block 51N by	**None**	50HS & 50HSN	50HS	50HSN

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A1900	**Directional Phase Time Overcurrent (67)**				
A1901	Function 67	Enabled		**Disabled**	
A1902	Curve 67	Inverse	Short Inverse	Long Inverse	Moderately Inverse
		Custom	**Very Inverse**	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
A1903	Pickup 67 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
A1905	Time Dial 67	**0.10**	Range: 0.1-9.9 (0.1 steps)		
A1906	Filter 67	**rms**		fundamental	
A1907	Impedance 67	**45°**	Range: 0-90° (1° steps)		°
A1908	Direction 67	Normal		**Reverse**	
1910	Freeze Waveform 1 67	on Pickup	on Trip	**None**	
1911	Freeze Waveform 2 67	on Pickup	on Trip	**None**	
A2000	**Directional Neutral Time Overcurrent (67N)**				
A2001	Function 67N	Enabled		**Disabled**	
A2002	Curve 67N	**Inverse**	Short Inverse	Long Inverse	Moderately Inverse
		Custom	Very Inverse	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
A2003	Pickup 67N 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	(PU point is 1.06 of PU setting). 1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
A2005	Time Dial 67N	**0.10**	Range: 0.1-9.9 (0.1 steps)		
A2006	Filter 67N	**rms**		fundamental	
A2007	Impedance 67N	**45°**	Range: 0-90° (1° steps)		°
A2008	Direction 67N	Normal		**Reverse**	
2010	Freeze Waveform 1 67N	on Pickup	on Trip	**None**	
2011	Freeze Waveform 2 67N	on Pickup	on Trip	**None**	

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A2200	**Overvoltage (59)**						
A2201	Function 59	Enabled			**Disabled**		
A2202	Curve 59	Inverse	Moderately Inverse		Very Inverse	**Definite Inverse**	
A2203	Pickup Source Voltage 59 (if VT mode is (L-N)	**Line-to-Line**			Line-to-Neutral		
A2204	Pickup 59	**130 V**	Range: 60-250 V (0.1 V steps)			V	
A2205	Time Delay 59 (Definite)	**0.10 s**	Range: 0-60 s (0.01 s steps), or ∞			s	
A2206	Time Dial 59 (Inverse)	**0.1**	Range: 0.1-9.9 (0.1 steps)				
2210	Freeze Waveform 1 59	on Pickup		on Trip		**None**	
2211	Freeze Waveform 2 59	on Pickup		on Trip		**None**	
A2300	**Undervoltage (27)**						
A2301	Function 27	Enabled			**Disabled**		
A2302	Curve 27	Inverse	Moderately Inverse		Very Inverse	**Definite Inverse**	
A2303	PU Source V 27 (if VT mode is (L-N)	**Line-to-Line**			Line-to-Neutral		
A2304	Pickup 27	**50 V**	Range: 40-230 V (0.1 V steps)			V	
A2305	Time Delay 27 (Definite)	**0.10 s**	Range: 0-60 s (0.01 s steps), or ∞			s	
A2306	Time Dial 27 (Inverse)	**0.1**	Range: 0.1-9.9 (0.1 steps)				
2310	Freeze Waveform 1 27	on Pickup		on Trip		**None**	
2311	Freeze Waveform 2 27	on Pickup		on Trip		**None**	

A2400	**Phase Sequence Voltage (47) Negative Sequence Voltage (47N)**					
A2401	Function 47	Enabled		**Disabled**		
2410	Freeze Waveform 1 47	---	on Trip		**None**	
2411	Freeze Waveform 2 47	---	on Trip		**None**	
A2451	Function 47N	**Enabled**		Disabled		
A2452	Curve 47N	Inverse		**Definite Inverse**		
A2453	Pickup 47N	**10%**	Range: 4-40% (1% steps)			%
A2454	Time Delay 47N(Defin.)	**0.00 s**	Range: 0-100 s (0.01 s steps), or ∞			s
A2455	Time Dial 47N (Inverse)	**0.10**	Range: 0.1-9.9 (0.1 steps)			
A2456	Maximum Time (Inverse)	**120 s**	Range: 1-250 s (1 s steps)			s
A2457	Block 47N by	**40 V**	Range: 40-120 V (1 V steps)			V
2460	Freeze Waveform 1 47N	on pickup	on Trip		**None**	
2461	Freeze Waveform 2 47N	on pickup	on Trip		**None**	

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A2500	**Overfrequency (81O) Underfrequency (81U)**				
A2501	Function 81O	Enabled		**Disabled**	
A2502	Pickup 81O	**62.0 Hz**	Range: 60.1-65.0 Hz (0.1 Hz steps)		Hz
A2504	Time Delay 81O	**0.10 s**	Range: 0-100 s (0.01 s steps), or ∞		s
2506	Block 81O	**40 V**	Range: 40-120 V (1 V steps)		V
2510	Frz. Wfm1 81O	on Pickup	on Trip		**None**
2511	Frz. Wfm2 81O	on Pickup	on Trip		**None**
A2551	Function 81U	Enabled		**Disabled**	
A2553	Pickup 81U	**58.0 Hz**	Range: 55.0-59.9 Hz (0.1 Hz steps)		Hz
A2554	Delay 81U	**0.10 s**	Range: 0-100 s (0.01 s steps), or ∞		s
A2556	Block 81U	**40 V**	Range: 40-120 V (1 V steps)		V
2560	Freeze Waveform 1 81U	on pickup	on Trip		**None**
2561	Freeze Waveform 2 81U	on pickup	on Trip		**None**
2800	**Breaker Failure (50BF)**				
2801	Function 50BF	Enabled		**Disabled**	
2803	Pickup 50BF 5 A CT	**0.25 A**	Range: 0.25-5.0 A (0.01 A steps)		A
	1 A CT	**0.1 A**	Range: 0.02-1.0 A (0.01 A steps)		A
2804	Delay 50BF	**10 cycles**	Range: 8-254 cycles		cycles
2805	Monitor 50BF	**current**	breaker		both

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3000	**Alarm Setpoints**						
3100	**Demand Setpoints**						
3101	Demand Interval	**15**	30	60	minutes		
3102	Sync time	**0**	15	30	45	minutes after hour	
3103	Subperiods 60	**1**	2	3	4	6	12
3104	Subperiods 30	**1**	2	3	6		
3105	Subperiods 15	**1**	3				
3106	Current Average Demand	Enabled			**Disabled**		
3107	Current Average Demand Pickup	**3000 A**	Range: 0-9999 A (1 A steps)			A	
3108	KW Demand	Enabled			**Disabled**		
3109	KW Demand Pickup	**100000 kW**	Range: 0-999,999 kW (1 kW steps)			kW	
3200	**Power Setpoints**						
3201	KVAR Function	Enabled			**Disabled**		
3202	KVAR Pickup	**100000 kVAR**	Range: 0-999,999 kVAR (1 kVAR steps)			kVAR	
3203	KVAR Time Delay	**1800 s**	Range: 0-3600 s (1 s steps)			s	
3204	KVA Function	Enabled			**Disabled**		
3205	KVA Pickup	**100000 kVA**	Range: 0-999,999 kVA (1 kVA steps)			kVA	
3206	KVA Time Delay	**1800 s**	Range: 0-3600 s (1 s steps)			s	
3207	PF Lead Function	Enabled			**Disabled**		
3208	PF Lead Pickup	**0.8**	Range: 0.2-1.0 (0.1 steps)				
3209	PF Lead Sign	Lag			**Lead**		
3210	PF Lead Delay	**1800 s**	Range: 0-3600 s (1 s steps)			s	
3211	PF Lag Function	Enabled			**Disabled**		
3212	PF Lag Pickup	**0.8**	Range: 0.2-1.0 (0.1 steps)				
3213	PF Lag Sign	**Lag**			Lead		
3214	PF Lag Delay	**1800 s**	Range: 0-3600 s (1 s steps)			s	

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3400	**Value Supervision**			
3401	Voltage Balance Function	Enabled	**Disabled**	
3402	Voltage Balance Pickup	**100 V**	Range: 40-120 V (0.1 V steps)	V
3404	Voltage Balance Factor	**0.80**	Range: 0.58-0.95 (0.01 teps)	
3411	Current Sum Function	Enabled	**Disabled**	
3412	Current Sum Pickup 5 A CT	**0.5 A**	Range: 0.5-5 A (0.1 A steps)	A
	1 A CT	**0.1 A**	Range: 0.1-1 A (0.1 A steps)	A
3414	Current Sum Factor	**0.10**	Range: 0.10-0.95 (0.01 steps)	
3411	Current Balance Function	Enabled	**Disabled**	
3412	Current Balance Pickup 5 A CT	**2.5 A**	Range: 0.5-5 A (0.1 A steps)	A
	1 A CT	**0.1 A**	Range: 0.1-1 A (0.1 A steps)	A
3414	Current Balance Factor	**0.80**	Range: 0.10-0.95 (0.01 steps)	
3500	**Breaker Operation**			
3501	Interrupted Current Function	Enabled	**Disabled**	
3502	Interrupted Current Pickup	**1000.00 kA**	Range: 0-9999.9 kA (1 kA steps)	kA
3503	Breaker Operations Functions	Enabled	**Disabled**	
3504	Breaker Operations Counter	**100**	Range: 0-65535	

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6000	**Matrixing**					
6100	**Binary Inputs**					
6101	Input 1	001	Frz.Buff1 Hi	Frz.Buff1 Lo	Frz.Buff2 Hi	Frz.Buff2 Lo
		002	blk 47N Hi	blk 47N Lo	blk 47 Hi	blk 47 Lo
		003	blk 81U Hi	blk 81U Lo	blk 81O Hi	blk 81O Lo
		004	blk 50 Hi	blk 50 Lo	blk 50N Hi	blk 50N Lo
		005	blk 50HS	blk 50HS Lo	blk 50HSN Hi	blk 50HSN Lo
		006	blk 51N Hi	blk 51N Lo	blk 59 Lo	blk 59 Hi
		007	blk 27 Hi	blk 27 Lo	blk 67 Hi	blk 67 Lo
		008	blk 67N Hi	blk 67N Lo	blk 50BF Hi	blk 50BF Lo
		009	blk ComEvt Hi	blkComEvt Lo	SwitchPara Hi	SwitchPara Lo
		010	**BI1 Hi** (001)	BI1 Lo	BI2 Hi	BI2 Lo
			BI3 Hi	BI3 Lo	BI4 Hi	BI4 Lo
			not matrixed			
6102	Input 2	001	Frz.Buff1 Hi	Frz.Buff1 Lo	Frz.Buff2 Hi	Frz.Buff2 Lo
		002	blk 47N Hi	blk 47N Lo	blk 47 Hi	blk 47 Lo
		003	blk 81U Hi	blk 81U Lo	blk 81O Hi	blk 81O Lo
		004	blk 50 Hi	blk 50 Lo	blk 50N Hi	blk 50N Lo
		005	blk 50HS	blk 50HS Lo	blk 50HSN Hi	blk 50HSN Lo
		006	blk 51N Hi	blk 51N Lo	blk 59 Lo	blk 59 Hi
		007	blk 27 Hi	blk 27 Lo	blk 67 Hi	blk 67 Lo
		008	blk 67N Hi	blk 67N Lo	blk 50BF Hi	blk 50BF Lo
		009	blk ComEvt Hi	blkComEvt Lo	SwitchPara Hi	SwitchPara Lo
		010	BI1 Hi	BI1 Lo	**BI2 Hi** (001)	BI2 Lo
			BI3 Hi	BI3 Lo	BI4 Hi	BI4 Lo
			not matrixed			

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6100	Binary Inputs (continued)					
6103	Input 3	001	Frz.Buff1 Hi	Frz.Buff1 Lo	Frz.Buff2 Hi	Frz.Buff2 Lo
		002	blk 47N Hi	blk 47N Lo	blk 47 Hi	blk 47 Lo
		003	blk 81U Hi	blk 81U Lo	blk 81O Hi	blk 81O Lo
		004	blk 50 Hi	blk 50 Lo	blk 50N Hi	blk 50N Lo
		005	blk 50HS	blk 50HS Lo	blk 50HSN Hi	blk 50HSN Lo
		006	blk 51N Hi	blk 51N Lo	blk 59 Lo	blk 59 Hi
		007	blk 27 Hi	blk 27 Lo	blk 67 Hi	blk 67 Lo
		008	blk 67N Hi	blk 67N Lo	blk 50BF Hi	blk 50BF Lo
		009	blk ComEvt Hi	blkComEvt Lo	SwitchPara Hi	SwitchPara Lo
		010	BI1 Hi	BI1 Lo	BI2 Hi	BI2 Lo
			BI3 Hi (001)	BI3 Lo	BI4 Hi	BI4 Lo
			not matrixed			
6104	Input 4	001	Frz.Buff1 Hi	Frz.Buff1 Lo	Frz.Buff2 Hi	Frz.Buff2 Lo
		002	blk 47N Hi	blk 47N Lo	blk 47 Hi	blk 47 Lo
		003	blk 81U Hi	blk 81U Lo	blk 81O Hi	blk 81O Lo
		004	blk 50 Hi	blk 50 Lo	blk 50N Hi	blk 50N Lo
		005	blk 50HS	blk 50HS Lo	blk 50HSN Hi	blk 50HSN Lo
		006	blk 51N Hi	blk 51N Lo	blk 59 Lo	blk 59 Hi
		007	blk 27 Hi	blk 27 Lo	blk 67 Hi	blk 67 Lo
		008	blk 67N Hi	blk 67N Lo	blk 50BF Hi	blk 50BF Lo
		009	blk ComEvt Hi	blkComEvt Lo	SwitchPara Hi	SwitchPara Lo
		010	BI1 Hi	BI1 Lo	BI2 Hi	BI2 Lo
			BI3 Hi	BI3 Lo	**BI4 Hi** (001)	BI4 Lo
			not matrixed			

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6200	Binary Outputs					
6201	Output 1	001	BI1	BI2	BI3	BI4
		002	Error Sum I	Error Sym I	Error Sym V	OC Pickup
		003	OC Trip	Non OC PU	Non OC Trip	Relay Pickup
		004	Relay Tripped	no f	f <>	50HS Trip
		005	50HSN Trip	81O Pickup	81O Trip	UV blks 81O
		006	81U Pickup	81U Trip	UV blks 81U	47N Pickup
		007	47N Trip	UV blks 47N	50HS blks 50	50HSN blks 50
		008	50 Pickup	50 Trip	50HS blks 50N	50HSN blks 50N
		009	50N Pickup	50N Trip	50HS blks 51	50HSN blks 51
		010	51 Pickup	51 Trip	50HS blks 51N	50HSNbl. 51N
		011	51N Pickup	51N Trip	67 Pickup	67 Trip
		012	67N Pickup	67N Trip	27 Pickup	27 Trip
		013	59 Pickup	59 Trip	47 Trip	OvrBrOps PU
		014	OvrbrAmpsPU	OvrAmpsDmd PU	OvrkWDmdPU	OvrkVAR PU
		015	OvrkVA Pickup	PFLag Pickup	PFLead Pickup	50BF Pickup
		016	50BF Trip	TrScMon PU	TrCoilCont PU	BrMech PU
		017	CommEvent 1	CommEvent 2	CommEvent 3	CommEvent 4
		018	CommEvent 5	**not matrixed**		
		019				
		020				

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6200	Binary Outputs (continued)					
6202	Output 2	001	BI1	BI2	BI3	BI4
		002	Error Sum I	Error Sym I	Error Sym V	OC Pickup
		003	OC Trip	Non OC PU	Non OC Trip	Relay Pickup
		004	Relay Tripped	no f	f <>	50HS Trip
		005	50HSN Trip	81O Pickup	81O Trip	UV blks 81O
		006	81U Pickup	81U Trip	UV blks 81U	47N Pickup
		007	47N Trip	UV blks 47N	50HS blks 50	50HSN blks 50
		008	50 Pickup	50 Trip	50HS blks 50N	50HSN blks 50N
		009	50N Pickup	50N Trip	50HS blks 51	50HSN blks 51
		010	51 Pickup	51 Trip	50HS blks 51N	50HSNbl. 51N
		011	51N Pickup	51N Trip	67 Pickup	67 Trip
		012	67N Pickup	67N Trip	27 Pickup	27 Trip
		013	59 Pickup	59 Trip	47 Trip	OvrBrOps PU
		014	OvrbrAmpsPU	OvrAmpsDmd PU	OvrkWDmdPU	OvrkVAR PU
		015	OvrkVA Pickup	PFLag Pickup	PFLead Pickup	50BF Pickup
		016	50BF Trip	TrScMon PU	TrCoilCont PU	BrMech PU
		017	CommEvent 1	CommEvent 2	CommEvent 3	CommEvent 4
		018	CommEvent 5	**not matrixed**		
		019				
		020				

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6400	Trip Contacts					
6401	Contact 1	001	BI1	BI2	BI3	BI4
		002	OC Trip	Non OC Trip	Relay Tripped	50HS Trip
		003	50HSN Trip	81O Trip	81U Trip	47N Trip
		004	(005) 50 Trip	(002) **50N Trip**	(003) **51 Trip**	(004) 51N Trip
		005	67 Trip	67N Trip	27 Trip	59 Trip
		006	47Trip	OvrBrOps PU	OvrbrAmpsPU	OvrAmpsDmd PU
		007	OvrkWDmdPU	OvrkVAR PU	OvrkVA Pickup	PFLag Pickup
		008	PFLead Pickup	50BF Pickup	TrScMon PU	TrCoilCont PU
		009	BrMech PU	(001) **CommEvent 1**	CommEvent 2	CommEvent 3
		010	CommEvent 4	CommEvent 5	not matrixed	
6402	Contact 2	001	BI1	BI2	BI3	BI4
		002	OC Trip	Non OC Trip	Relay Tripped	50HS Trip
		003	50HSN Trip	81O Trip	81U Trip	47N Trip
		004	50 Trip	50N Trip	51 Trip	51N Trip
		005	67 Trip	67N Trip	27 Trip	59 Trip
		006	47Trip	OvrBrOps PU	OvrbrAmpsPU	OvrAmpsDmd PU
		007	OvrkWDmdPU	OvrkVAR PU	OvrkVA Pickup	PFLag Pickup
		008	PFLead Pickup	50BF Pickup	TrScMon PU	TrCoilCont PU
		009	BrMech PU	CommEvent 1	(001) **CommEvent 2**	CommEvent 3
		010	CommEvent 4	CommEvent 5	not matrixed	

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6400	Trip Contacts (continued)					
6403	Contact 3	001 002	BI1	BI2	BI3	BI4
		003 004	OC Trip	Non OC Trip	Relay Tripped	50HS Trip
		005 006	50HSN Trip	81O Trip	81U Trip	47N Trip
		007 008	50 Trip	50N Trip	51 Trip	51N Trip
		009 010	67 Trip	67N Trip	27 Trip	59 Trip
		011 012	47Trip	OvrBrOps PU	OvrbrAmpsPU	OvrAmpsDmd PU
		013 014	OvrkWDmdPU	OvrkVAR PU	OvrkVA Pickup	PFLag Pickup
		015 016	PFLead Pickup	50BF Pickup	TrScMon PU	TrCoilCont PU
		017 018	BrMech PU	CommEvent 1	CommEvent 2	CommEvent 3
		019 020	CommEvent 4	CommEvent 5	**not matrixed**	

7000	Operating Parameters									
7005	LCD Line 1	**Iavg**	Idmd1	Idmd2	Idmd3	Idmd avg	V1-2	V2-3	V3-1	VLLavg
		V1-N	V2-N	V3-N	VLNavg	W	WH	Wdmd	VA	VAR
		VARH	PF	f	I1	I2	I3	IN		
7006	LCD Line 2	Iavg	Idmd1	Idmd2	Idmd3	**Idmd avg**	V1-2	V2-3	V3-1	VLLavg
		V1-N	V2-N	V3-N	VLNavg	W	WH	Wdmd	VA	VAR
		VARH	PF	f	I1	*I2*	I3	IN		

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7100	**Parameter Set**				
7103	Activation	**Set A**		Set B	
7200	**Configure Communicatins Port**				
7201	Local Port	2400 baud	**4800 baud**	9600 baud	19200 baud
7202	System Port	2400 baud	**4800 baud**	9600 baud	19200 baud
7203	Param. Change	**Enabled**		Disabled	
7204	Comm Events	**Enabled**		Disabled	
7207	Local Address	**222**		1-254	
7300	**Configure Password**				
7301	CW Level 1	1 to 5 digits			
7302	CW Level 2	1 to 5 digits			
7303	CW Level 3	1 to 5 digits			
7400	**Relay Data (7401 must be set in Wisdom, copy relay information in case of customer service requests)**				
7401	Circuit Name	string of up to 16 characters			
7402	MainBd S/N	main board serial number			
7403	MainBd ID	main board identification number			
7404	OptBd1 S/N	option board 1 serial number			
7405	OptBd1 ID	option board 1 identification number			
7406	OptBd2 S/N	option board 2 serial number			
7407	OptBd1 ID	option board 2 identification number			
8100	**Date and Time**				
8101	Set Date	mm.dd.yyyy			
8102	Set Time	hh.mm.ss			

8200	**Resets**			
8211	Breaker Ops		0-65535	
8212	Sum IL1		Range: 0-99999 kA (0.01 kA steps)	kA
8213	Sum IL2		Range: 0-99999 kA (0.01 kA steps)	kA
8214	Sum IL3		Range: 0-99999 kA (0.01 kA steps)	kA
8300	**Breaker Monitoring**			
8301	Trip Source Impedance	Enabled	**Disabled**	
8302	Trip Source Fail	Yes	**No**	
8303	Trip Coil Cont.	Enabled	**Disabled**	
8304	Trip Coil Fail	Yes	**No**	
8305	Breaker Mech	Enabled	**Disabled**	
8400	**Waveform Capture**			
8401	Waveform 1 Pretrip	**800 ms**	Range: 100-900 ms (1 ms steps)	ms
8402	Waveform 2 Pretrip	**800 ms**	Range: 100-900 ms (1 ms steps)	ms

B1500	**Instantaneous Phase Overcurrent (50) High-Set Instantaneous Phase Overcurrent (50HS)**				
B1501	Function 50	**Enabled**		Disabled	
B1502	Pickup 50 5 A CT	**1.0 A**	Range: 1-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
B1504	Time Delay 50	**0.00 s**	Range: 0-60 s (0.01 s steps)		s
1510	Freeze Waveform 1 50	**Settings displayed or changed here apply to both parameter sets**			
1511	Freeze Waveform 2 50	**Settings displayed or changed here apply to both parameter sets**			
B1512	Block 50 by	**None**	50HS & 50HSN	50HS	50HSN
B1551	Function 50HS	**Enabled**		Disabled	
B1552	Pickup 50HS 5 A CT	**5.0 A**	Range: 5-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
1560	Freeze Waveform 1 50HS	**Settings displayed or changed here apply to both parameter sets**			
1561	Freeze Waveform 2 50HS	**Settings displayed or changed here apply to both parameter sets**			
B1600	**Instantaneous Neutral or Ground Overcurrent (50N) High-Set Instantaneous Neutral or Ground Overcurrent (50HSN)**				
B1601	Function 50N	**Enabled**		Disabled	
B1602	Pickup 50N 5 A CT	**1.0 A**	Range: 1-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
B1604	Time Delay 50N	**0.00 s**	Range: 0-60 s (0.01 s steps)		s
1610	Freeze Waveform 1 50N	**Settings displayed or changed here apply to both parameter sets**			
1611	Freeze Waveform 2 50N	**Settings displayed or changed here apply to both parameter sets**			
B1612	Block 50N by	**None**	50HS & 50HSN	50HS	50HSN
B1651	Function 50HSN	**Enabled**		Disabled	
B1652	Pickup 50HSN 5 A CT	**5.0 A**	Range: 5-120 A (0.1 A steps)		A
	1 A CT	**0.2 A**	Range: 0.2-24 A (0.1 A steps)		A
1660	Freeze Waveform 1 50HSN	**Settings displayed or changed here apply to both parameter sets**			
1661	Freeze Waveform 2 50HSN	**Settings displayed or changed here apply to both parameter sets**			

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B1700	**Phase Time Overcurrent (51)**				
B1702	Curve 51	Inverse	Short Inverse	Long Inverse	Moderately Inverse
		Custom	**Very Inverse**	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
B1703	Pickup 51 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	(PU point is 1.06 of PU setting). 1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
B1705	Time Dial 51	**0.1**	Range: 0.1-9.9 (0.1 steps)		
B1706	Filter 51	**rms**		fundamental	
B1709	Reset 51	Disk Emulation		**Instantaneous**	
1710	Freeze Waveform 1 51	**Settings displayed or changed here apply to both parameter sets**			
1711	Freeze Waveform 2 51	**Settings displayed or changed here apply to both parameter sets**			
B1712	Block 51 by	**None**	50HS & 50HSN	50HS	50HSN
B1800	**Neutral Time Overcurrent (51N)**				
B1801	Function 51N	**Enabled**		Disabled	
B1802	Curve 51N	**Inverse**	Short Inverse	Long Inverse	Moderately Inverse
		Custom	Very Inverse	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
B1803	Pickup 51N 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
B1805	Time Dial 51N	**0.1**	Range: 0.1-9.9 (0.1 steps)		
B1806	Filter 51N	**rms**		fundamental	
B1809	Reset 51N	Disk Emulation		**Instantaneous**	
1810	Freeze Waveform 1 51N	**Settings displayed or changed here apply to both parameter sets**			
1811	Freeze Waveform 2 51N	**Settings displayed or changed here apply to both parameter sets**			
B1812	Block 51N by	**None**	50HS & 50HSN	50HS	50HSN

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B1900	**Directional Time Overcurrent (67)**				
B1901	Function 67	Enabled		**Disabled**	
B1902	Curve 67	Inverse	Short Inverse	Long Inverse	Moderately Inverse
		Custom	**Very Inverse**	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
B1903	Pickup 67 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
B1905	Time Dial 67	**0.1**	Range: 0.1-9.9 (0.1 steps)		
B1906	Filter 67	**rms**		fundamental	
B1907	Impedance 67	**45°**	Range: 0-90° (1° steps)		°
B1908	Direction 67	Normal		**Reverse**	
1910	Freeze Waveform 1 67	**Settings displayed or changed here apply to both parameter sets**			
1911	Freeze Waveform 2 67	**Settings displayed or changed here apply to both parameter sets**			
B2000	**Directional Neutral Time Overcurrent (67N)**				
B2001	Function 67N	Enabled		**Disabled**	
B2002	Curve 67N	**Inverse**	Short Inverse	Long Inverse	Moderately Inverse
		Custom	Very Inverse	Extremely Inverse	Definite Inverse
		Slightly Inverse	I^2T without Limit		
B2003	Pickup 67N 5 A CT	**0.5 A**	Range: 0.5-20 A (0.1 A steps)		A
	(PU point is 1.06 of PU setting). 1 A CT	**0.1 A**	Range: 0.1-4 A (0.1 A steps)		A
B2005	Time Dial 67N	**0.1**	Range: 0.1-9.9 (0.1 steps)		
B2006	Filter 67N	**rms**		fundamental	
B2007	Impedance 67N	**45°**	Range: 0-90° (1° steps)		°
B2008	Direction 67N	Normal		**Reverse**	
2010	Freeze Waveform 1 67N	**Settings displayed or changed here apply to both parameter sets**			
2011	Freeze Waveform 2 67N	**Settings displayed or changed here apply to both parameter sets**			

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B2200	**Overvoltage (59)**						
B2201	Function 59	Enabled		**Disabled**			
B2202	Curve 59	Inverse	Moderately Inverse	Very Inverse	**Definite Inverse**		
B2203	Pickup Source Voltage 59 (if VT mode is (L-N)	**Line-to-Line**		Line-to-Neutral			
B2204	Pickup 59	**130 V**	Range: 60-250 V (0.1 V steps)			V	
B2205	Time Delay 59 (Definite)	**0.10 s**	Range: 0-60 s (0.01 s steps), or ∞			s	
B2206	Time Dial 59 (Inverse)	**0.1**	Range: 0.1-9.9 (0.1steps)				
2210	Freeze Waveform 1 59	**Settings displayed or changed here apply to both parameter sets**					
2211	Freeze Waveform 2 59	**Settings displayed or changed here apply to both parameter sets**					
B2300	**Undervoltage (27)**						
B2301	Function 27	Enabled		**Disabled**			
B2302	Curve 27	Inverse	Moderately Inverse	Very Inverse	**Definite Inverse**		
B2303	PU Source V 27 (if VT mode is (L-N)	**Line-to-Line**		Line-to-Neutral			
B2304	Pickup 27	**50.0 V**	Range: 40-230 V (0.1 V steps)			V	
B2305	Time Delay 27 (Definite)	**0.10 s**	Range: 0-60 s (0.01 s steps), or ∞			s	
B2306	Time Dial 27 (Inverse)	**0.1**	Range: 0.1-9.9 (0.1 steps)				
2310	Freeze Waveform 1 27	**Settings displayed or changed here apply to both parameter sets**					
2311	Freeze Waveform 2 27	**Settings displayed or changed here apply to both parameter sets**					

B2400	**Phase Sequence Voltage (47) Negative Sequence Voltage (47N)**			
B2401	Function 47	Enabled	**Disabled**	
2410	Freeze Waveform 1 47	**Settings displayed or changed here apply to both parameter sets**		
2411	Freeze Waveform 2 47	**Settings displayed or changed here apply to both parameter sets**		
B2451	Function 47N	Enabled	**Disabled**	
B2452	Curve 47N	Inverse	**Definite Inverse**	
B2453	Pickup 47N	**10%**	Range: 4-40% (1% steps)	%
B2454	Time Delay 47N(Defin.)	**0.00 s**	Range: 0-100 s (0.01 s steps), or ∞	s
B2455	Time Dial 47N (Inverse)	**0.1**	Range: 0.1-9.9 (0.1 steps)	
B2456	Maximum Time (Inverse)	**120 s**	Range: 1-250 s (1 s steps)	s
B2457	Block 47N by	**40 V**	Range: 40-120 V (1 V steps)	V
2460	Freeze Waveform 1 47N	**Settings displayed or changed here apply to both parameter sets**		
2461	Freeze Waveform 2 47N	**Settings displayed or changed here apply to both parameter sets**		
B2500	**Overfrequency (81O) Underfrequency (81U)**			
B2501	Function 81O	Enabled	**Disabled**	
B2502	Pickup 81O	**62.0 Hz**	Range: 60.1-65.0 Hz (0.1 Hz steps)	Hz
B2504	Time Delay 81O	**0.10 s**	Range: 0-100 s (0.01 s steps), or ∞	s
2506	Block 81O	**40 V**	Range: 40-120 V (1 V steps)	V
2510	Frz. Wfm1 81O	**Settings displayed or changed here apply to both parameter sets**		
2511	Frz. Wfm2 81O	**Settings displayed or changed here apply to both parameter sets**		
B2551	Function 81U	Enabled	**Disabled**	
B2553	Pickup 81U	**58.0 Hz**	Range: 55.0-59.9 Hz (0.1 Hz steps)	Hz
B2554	Delay 81U	**0.10 s**	Range: 0-100 s (0.01 s steps), or ∞	s
B2556	Block 81U	**40 V**	Range: 40-120 V (1 V steps)	V
2560	Freeze Waveform 1 81U	**Settings displayed or changed here apply to both parameter sets**		
2561	Freeze Waveform 2 81U	**Settings displayed or changed here apply to both parameter sets**		

address Unique four-digit number representing the location of a specific function parameter stored in the ISGS relay.

address block Unique four-digit number ending in two zeros representing the location of a specific function stored in the ISGS relay.

average line voltage Arithmetic average of AB, BC, CA line-to-line voltage (3-wire and 4-wire modes) (VAB+VBC+VCA)/3 = VAVG.

average phase current Arithmetic average of phase A, B, and C currents. (IA+IB+IC)/3 = IAVG.

average phase voltage Arithmetic average of A, B, and C phase voltages (4-wire mode only). (VA+VB+VC)/3 = VAVG.

binary input Optically isolated voltage level sensor with a fixed threshold. The input is considered activated if voltage above the threshold is applied and de-activated if no voltage or voltage below the threshold is applied. The status of a binary input is monitored by the relay and state changes are recorded in the event log. Actions matrixed to a binary input can be set to be performed when the binary input is activated (hi) or de-activated (lo).

binary output ANSI rated dry output contact that can be matrixed to a binary input of a protective function for closing.

Breaker Failure (50BF) Relay function that responds to a fault condition where any phase current being measured by a CT does not drop below a programmed level. Whenever another protective function activates the contact identified by the breaker parameter, this function will wait until the set amount of time has expired. Then it checks the phase currents. If they are not equal to or less than the set pickup value, the function executes its defined actions.

Breaker Mechanism Relay function that can be enabled to sense a breaker mechanism error and cause an action to be taken and an event being logged if the a- and b-switches are ever both closed continuously for more than 100 ms. No other time delay is implemented. When this function detects the error, it is considered to be in pickup. It goes out of pickup when the condition is no longer present.

Caution Indicates a potentially hazardous situation which, if not avoided, could result in moderate or minor injury.

Comm Event Relay function that can be set to allow the remote activation of the breaker and binary outputs.

CT Configuration A function to set up the ISGS relay to match phase CT primary rating, neutral or ground CT primary rating, and the CT input's normal power flow settings of an electrical distribution system.

Current Balance Relay function that protects against an unbalance in the phase currents. The function monitors the phase currents for approximate balance (of equal magnitude). Balance is defined as the ratio of minimum to maximum current, where the maximum current is the largest and the minimum current the smallest of the three phase currents. The current is considered balanced and will not cause an alarm. The function monitors for balance when the maximum current is larger than the current balance pickup value. An alarm occurs when the min/max ratio is smaller than the current balance factor.

current sensor Toroidal current transformer providing current level data and operating power for fault protection and metering. Its rated primary current establishes the maximum continuous current rating of the circuit breaker. Its rated secondary current is 0.5 A at rated primary current. Sensors used in Static Trip III trip units are encapsulated in polymeric material to protect the windings and prevent motion during short circuit fault conditions.

Curve Parameter of several ISGS protective functions that allows the selection of a definite time delay or a characteristic curve.

custom curve A user-definable protective curve.

Danger Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Device Configuration A function to set up the ISGS relay to match line frequency, phase sequence, and breaker connection settings of an electrical distribution system.

Directional Neutral or Ground Time Overcurrent (67N) Relay function that protects against neutral or ground time overcurrent condition. This function uses a selected time overcurrent characteristic curve to determine the trip time, and the voltages present on the VTs to determine the current direction. Tripping occurs when the neutral or ground current exceeds the programmed pickup at 100% or drops below the pickup at 95% for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overcurrent condition subsides in less time than the delay time, the pickup will go inactive and the directional neutral or ground overcurrent function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

Directional Phase Time Overcurrent (67) Relay function that protects against a phase overcurrent condition. This function uses a selected time overcurrent characteristic curve to determine the trip time, and the voltages present on the VTs to determine the current direction. Tripping occurs when any one phase current exceeds the programmed pickup at 100% or drops below the pickup at 95% for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overcurrent condition subsides in less time than the delay time, the pickup will go inactive and the directional phase overcurrent function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

event log Chronological record of significant events that occur during relay operation. Includes operation and fault events.

Filter Parameter of several ISGS protective functions that sets the sensing method—rms or fundamental—used by the function in its pickup calculations.

Forward Parameter setting of several ISGS functions that allows the directional protection element to pickup on fault current only in the direction of normal power flow.

High-Set Instantaneous Neutral or Ground Overcurrent (50HSN) A relay function that protects against a neutral or ground overcurrent condition. Tripping occurs when the neutral or ground current exceeds the programmed pickup at 100%. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

High-Set Instantaneous Phase Overcurrent (50HS) A relay function that protects against a phase overcurrent condition. Tripping occurs when any one phase current exceeds the programmed pickup at 100%. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

Impedance Parameter of several ISGS protective functions that set the angle used by this function. Impedance determines the direction of current flow being measured and can be set from 0 to 90 degrees in steps of 1 degree.

Instantaneous Neutral or Ground Overcurrent (50N) A relay function that protects against a neutral or ground overcurrent condition. Tripping occurs when the neutral or ground current exceeds the programmed pickup at 100% or drops below the pickup at 95% for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overcurrent condition subsides in less time than the delay time, the pickup will go inactive and the instantaneous neutral or ground overcurrent function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

Instantaneous Phase Overcurrent (50) A relay function that protects against a phase overcurrent condition. Tripping occurs when any one phase current exceeds the programmed pickup at 100% or drops below the pickup at 95% for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overcurrent condition subsides in less time than the delay time, the pickup will go inactive and the instantaneous phase overcurrent function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

Intelligent SwitchGear System (ISGS) High-speed, numerical, microprocessor-based protective relay designed to be easily incorporated into a computer monitored medium voltage power system.

ISGS see Intelligent SwitchGear System

LCD Two-line by sixteen character liquid crystal display that allows the viewing of parameters, real-time data, keypad entries, and messages.

logical input Input to a function internal to a relay, such as a blocking input for a function. Logical inputs can only be activated if matrixed to a physical input.

logical output Output of a function internal to a relay, such as logging an event.

matrixing Process of assigning inputs (actions) to outputs (reactions).

Negative Sequence Voltage (47N) Relay function that protects against a negative sequence voltage condition using a definite time or inverse time characteristic. Tripping occurs when the percent of negative phase sequence voltage exceeds the preset value for a specified time. This function resets instantaneously when the negative sequence voltage drops below pickup.

Neutral Time Overcurrent (51N) A relay function that protects against a neutral overcurrent condition by using a selected time overcurrent characteristics curve to determine the trip time. Tripping occurs when the neutral current exceeds the programmed pickup at 100% or drops below the pickup at 95% for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overcurrent condition subsides in less time than the delay time, the pickup will go inactive and the neutral time overcurrent function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

overcurrent fault protection Process where current signals from sensors are converted to digital voltages by a resistor network and analog to digital converters in a trip unit. The digital voltages are stored in temporary memory. A protection microprocessor reads these voltages and compares their values to the set of values entered by the user. When the microprocessor detects an overcurrent condition, it's software begins to process a defined protection function. During the process of the protection function, the microprocessor continues monitoring the incoming current level data. If the overcurrent condition continues until the processing is completed and the defined delay time has elapsed, a trip command is issued by the microprocessor. The trip command causes an output signal to be sent to a coil in the tripping actuator.

Overfrequency (81O) Relay function that protects against an overfrequency condition. Tripping occurs when the frequency exceeds the programmed overfrequency pickup for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overfrequency condition subsides in less time than the delay time, the pickup will go inactive and the overfrequency function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log. Pickup occurs when the frequency in greater than the pickup setting.

parameter set Many protective functions of an ISGS relay offer two sets of parameters—set A and set B. Each set can be selected to be the active set that controls the relay. Separate parameter sets are useful for seasonal or special operation settings.

Phase Sequence Voltage (47) Relay function that protects against a phase sequence voltage condition. Tripping occurs when the phase sequence voltage indicated in the hardware configuration is not present at the device voltage inputs. This function operates without delay or inverse time characteristic.

Phase Time Overcurrent (51) A relay function that protects against a phase overcurrent condition by using a selected time overcurrent characteristics curve to determine the trip time. Tripping occurs when any one phase current exceeds the programmed pickup at 100% or drops below the pickup at 95% for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the overcurrent condition subsides in less time than the delay time, the pickup will go inactive and the phase time overcurrent function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log.

physical input Hardware connection to a device, such as a binary input.

physical output A trip contact or binary output of a device.

Pickup Begin of timing.

Pickup LED Light-emitting diode (red) indicating a protective function in pickup.

Pickup Source Voltage Parameter of the ISGS Overvoltage (59) protective function that indicates the VT connection. If the VTs are connected line-to-ground, the device can pickup up on line-to-line or line-to-ground voltages. If the VTs are connected line-to-line, the VTs can only pickup on line-to-line voltages.

Power Flow A parameter of the CT Configuration function that can be set to indicate whether power enters (normal) or leaves (reverse) the polarity mark on the CTs.

Power On display The first LCD display shown when the ISGS relay is powered on. Its first line indicates the relay configuration, the second line displays the relay's catalog number.

Power On Meter display The LCD display that automatically replaces the Power On display after five seconds when the ISGS relay is powered on. Each line indicates a measured value that can be changed in address block 7000 of an ISGS relay.

Qualified Person One who is familiar with the installation, construction, and operation of this equipment, and the hazards involved. In addition, this person has the following qualifications: (1) training and authorization to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with the established safety practices; (2) training in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety procedures; (3) training in rendering first aid.

RMS filter Sensing method.

Setpoint In a feedback control loop, the point that determines the desired value of the quantity to be controlled.

standard operating procedures Routine steps describing how to display data, configure parameters, save changes, and switch parameter sets when manually operating the ISGS relay.

system LED Light-emitting diode (green) indicating the proper operation of the relay.

Time Delay A parameter of several ISGS protective functions that sets the time between pickup and trip. If the function remains in pickup for longer than the time delay, the function causes a trip.

Time Dial Parameter of several ISGS protective functions with characteristic curves that allows the raising or lowering of the time-to-trip.

Trip Coil Continuity Relay function that can be enabled to sense a trip coil continuity error and cause an action to be taken and an event being logged if the a- and b-switches are ever both continuously open for more than 100 ms. No other time delay is implemented. When this function detects the error, it is considered to be in pickup. It goes out of pickup when the condition is no longer present.

Trip LED Light-emitting diode (red) indicating that a protective function or remote command has initiated a trip. Reset by depressing the Target Reset key.

trip log Contains information of a protective function trip event.

Trip Source Impedance Relay function that can be set to monitor the trip supply voltage (auxiliary voltage, station battery) and perform an action if the voltage drops below ANSI minimums. This function can only be used in true DC trip systems.

tripping actuator Mechanism that is held in a charged position with a permanent magnet while the circuit breaker is open. When the mechanism is released, it causes the tripping of a circuit breaker. The output signal from a trip unit energizes a coil inside the actuator causing the magnetic flux to shift to a new path. This shift releases the stored energy of a spring located inside the actuator and trips the circuit breaker. When the circuit breaker mechanism opens, the actuator is automatically returned to the charged-and-held position by a reset mechanism. A second coil inside the tripping actuator is used to augment the holding power of the permanent magnet during high short circuit conditions so that stray magnetic fields will not cause unintended release or demagnetization while the trip unit is in short time delay.

Underfrequency (81U) Relay function that protects against an underfrequency condition. Tripping occurs when the frequency drops below the programmed underfrequency pickup for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a

trip to occur. If the underfrequency condition subsides in less time than the delay time, the pickup will go inactive and the underfrequency function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log. Pickup occurs when the frequency in greater than the pickup setting.

Undervoltage (27) Relay function that protects against a line-to-line undervoltage condition. Tripping occurs when the rms value of any one line-to-line voltage drops below the programmed undervoltage pickup for a period of time equal to the delay time setting. The pickup must remain active for the entire delay time for a trip to occur. If the undervoltage condition subsides in less time than the delay time, the pickup will go inactive and the undervoltage function will reset. When tripping occurs, the actual condition that caused the trip is recorded in the device's nonvolatile trip log. Pickup occurs when any one line-to-line voltage is less than the pickup setting.

value supervision The ability of the ISGS relay to monitor its own input and measurement functions for problems.

Voltage Balance Relay function that protects against an unbalance in the phase voltages. The function monitors the phase voltages for approximate balance (of equal magnitude). Balance is defined as the ratio of minimum to maximum voltage, where the maximum voltage is the largest and the minimum voltage the smallest of the three phase voltages. The voltage is considered balanced and will not cause an alarm if the voltage min/max ratio is larger than the voltage balance factor. The voltage balance factor indicates the amount of unbalance tolerated before the function generates an alarm. The function monitors for balance when the maximum voltage is larger than the voltage balance pickup value. An alarm occurs when the min/max ration is smaller than the voltage balance factor.

VT Configuration A function to set up an ISGS relay with voltage input option to match VT primary rating and VT connection settings of an electrical distribution system.

Warning Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Notes:

SIEMENS

Siemens Energy
& Automation, Inc.
Protective Relay Group
Customer Service
P.O. Box 29503
Raleigh, NC 27626-0503

Protective Relays Service Request Form

To report problems with Siemens protective relays, make a copy of this form, complete it with as much information as you can, and fax it to Siemens Customer Service at 919-365-2583. Call customer service during regular business hours at 919-365-2395. For **emergency service** call **1-800-241-4453**.

Customer Information

Company name: _____

Contact person at job site: _____

Contact person's phone number: _____

Contact person's fax number: _____

Location of installed device: _____

Product Information

Device type: _____

Serial Number: _____

Catalog number: _____

Sales Order Number: _____

Configuration Information

Operational settings: _____

_____

Parameters: _____

_____

Wiring: _____

_____

Type of system: _____

_____

Accessories Used

Communications software: _____

_____

Other devices: _____

_____

_____

Problem Description

_____

_____

_____

_____

_____

_____

Error Messages

_____

_____

_____

To be completed by Siemens:

Received by: _____ Date: _____ Reviewed by: _____ Date: _____

Problem report tracking number: _____ Problem classification code: _____

Sales engineer: _____

Corrective action taken: _____

_____

_____

_____

_____

_____

SIEMENS

FAX ORDER FORM

Wisdom™ Software

Wisdom software (for Windows®) simplifies the configuration of your ISGS™ relay. For a free copy, complete this form and fax it to:

Siemens Energy & Automation, Inc.

Protective Relay Group

FAX in US: 919-365-2552

Name (First, Middle Initial, Last)

Company Name

Title

Address

City

State **Zip Code** **Country**

Telephone

Fax

E-Mail Address

Siemens Sales Representative

User ☐ **Distributor** ☐ **Contractor** ☐ **Utility** ☐ **OEM** ☐

Are you currently using an ISGS relay? **Yes** ☐ **No** ☐

To download this software directly from the World Wide Web, visit our web site: **http://www.sea.siemens.com** and Search for *Wisdom Software*.

SIEMENS

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